



Novell® Open Enterprise Server Administrator's Handbook SUSE® LINUX® Edition

By Mike Latimer, Jeffrey Harris

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[Table of Contents](#) | [Index](#)

Overview

As an administrator of a Novell Open Enterprise Server on a SUSE Linux system, you are looking for ways to leverage it as a platform for delivering Novell's robust network services. Look no further. SUSE Linux and Open Enterprise Server Administrator's Handbook provides you with the information that you need to take advantage of the various Novell tools on a SUSE powered system. You will cover the major components and features of Open Enterprise Server (OES) on the SUSE Linux platform. By focusing on the implementation of OES on the SUSE Linux platform, you will understand how to integrate the benefits of OES in an existing environment. While this is not a reference work for network theory, protocols or architectures, it will provide you with a brief introduction to the concepts necessary to establish features. SUSE Linux Novell Open Enterprise Server Administrator's Handbook will provide you with quick access to the information about a technology, concept or utility that you need to get the job done.



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[Table of Contents](#) | [Index](#)

[Copyright](#)

[About the Author](#)

[Acknowledgments](#)

[We Want to Hear from You!](#)

[Reader Services](#)

[Part I. Open Enterprise Server Overview](#)

[Chapter 1. Introduction to Open Enterprise Server](#)

[Instant Access](#)

[Why Open Enterprise Server?](#)

[What Is Open Enterprise Server?](#)

[Chapter 2. Installing OES for Linux](#)

[Instant Access](#)

[Getting Ready for OES Linux](#)

[Installing OES Linux](#)

[Upgrading SLES9 to OES Linux](#)

[Common Post-Installation Tasks for OES Linux](#)

[Chapter 3. Working with SUSE Linux Enterprise Server 9](#)

[Instant Access](#)

[Logging in to Linux](#)

[The Shell and the GUI](#)

[Finding Your Way](#)

[Getting Help](#)

[Editing Text Files](#)

[Chapter 4. OES Linux Clients](#)

[Instant Access](#)

[The Traditional Novell Client](#)

[Installing the Client Software](#)

[Removing the Client Software](#)

[Installing from a Web Server](#)

[Upgrading the Novell Client](#)

[The Client Login](#)

[Configuring the Client](#)

[NetIdentity](#)

[Other Novell Clients](#)

[Accessing OES Through Native Linux Methods](#)

[Chapter 5. OES Management Tools](#)

[Instant Access](#)

[Welcome Pages](#)

[ConsoleOne](#)

[iManager](#)

[Novell Remote Manager](#)

[iMonitor](#)

[Part II. Open Enterprise Server Infrastructure](#)

[Chapter 6. SUSE Linux Enterprise Server Management](#)

[Instant Access](#)

[SLES Startup Procedures](#)

[Interacting with Processes](#)

[Introduction to Linux Kernel Management](#)

[Managing SLES with YaST](#)

[Updating OES Linux](#)

[Monitoring SLES with Health Monitoring Services](#)

[Troubleshooting](#)

[Chapter 7. Novell eDirectory Management](#)

[Instant Access](#)

[What Is eDirectory?](#)

[eDirectory Architecture](#)

[eDirectory Tree Design](#)

[Managing eDirectory](#)

[Using LDAP with eDirectory](#)

[DNS and DHCP Services](#)

[Chapter 8. Users and Network Security](#)

[Instant Access](#)

[Overview of Users in OES Linux](#)

[eDirectory User-Related Objects](#)

[eDirectory Authentication](#)

[eDirectory Authorization](#)

[Provisioning Linux Users](#)

[Chapter 9. OES Clustering Services](#)

[Instant Access](#)

[Clustering Benefits](#)

[Clustering Fundamentals](#)

[Clustering Terminology](#)

[Installing Novell Cluster Services](#)

[Configuring Novell Cluster Services](#)

[Always-Available File Access](#)

[Always-Available Network Services](#)

[Understanding Resource States](#)

[Chapter 10. Identity Manager Bundle Edition](#)

[Instant Access](#)

[How Identity Manager Works](#)

[Installing the Identity Manager Engine](#)

[Installing Remote Loaders and Drivers](#)

[Installing Identity Manager on a Secondary eDirectory Tree](#)

[Configuring an Identity Manager Driver](#)

[Identity Manager Password Synchronization](#)

[Part III. Open Enterprise Server User Access](#)

[Chapter 11. OES Linux File Storage and Management](#)

[Instant Access](#)

[Novell Storage Services](#)

[NSS Data Security](#)

[Backing Up and Restoring Files](#)

[Chapter 12. OES Linux File Access](#)

[Instant Access](#)

[Introduction to Novell File Access](#)

[NetStorage](#)

[Novell NetDrive](#)

[Novell iFolder](#)

[FTP Server](#)

[Chapter 13. OES Printing Services](#)

[Instant Access](#)

[Introduction to OES Printing](#)

[Setting Up a Secure Printing Environment](#)

[Part IV. Open Enterprise Server Web Services](#)

[Chapter 14. OES Foundations](#)

[Instant Access](#)

[Apache Web Server](#)

[Tomcat Servlet Engine](#)

[Chapter 15. OES Web Services](#)

[Instant Access](#)

[Novell Virtual Office](#)

[Novell QuickFinder](#)

[Novell eGuide](#)

[Additional OES Linux Web Services](#)

[Part V. Appendixes](#)

[Appendix A. The Most Essential Linux Commands](#)

[Getting Help](#)

[File Management](#)

[Permissions and Identity](#)

[Viewing Files](#)

[Text Processing](#)

[Finding Files and Text](#)

[Regular Expressions](#)

[Environmental Commands](#)

[Working with Processes](#)

[Troubleshooting Tools](#)

[Compression Utilities](#)

[Networking Utilities](#)

[Working with Filesystems](#)

[System Shutdown and Restart](#)

[Appendix B. eDirectory Reference Materials](#)

[eDirectory Background Processes](#)

[DSTrace with iMonitor](#)

[Repairing eDirectory with DSRepair](#)

[eDirectory Errors](#)

[Appendix C. Where to Go for More Information](#)

[General Novell Product Information](#)

[Novell on the Internet](#)

[Novell Cool Solutions](#)

[Novell AppNotes](#)

[Novell Connection](#)

[Novell Technical Support](#)

[Novell Ngage](#)

[DeveloperNet: Novell's Developer Support](#)

[Novell Training Classes and Certification](#)

[Advanced Technical Training](#)

[Novell Users International](#)

[Network Professional Association](#)

[Index](#)

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About the Author

Mike Latimer has worked at Novell's support organization for ten years, including expert third-level support on GroupWise and eDirectory. Mike is one of the founding members of Novell's SUSE LINUX Server support team, and provides advanced Linux training within the Novell organization, including Linux Professional Institute (LPI) courses and Guru training for Novell's technical staff.

Jeffrey L. Harris, a ten-year veteran of Novell, has worked throughout the Novell organization, including stints in Novell Technical Services, Major Market Sales Operations, Technical/Product Marketing, and Contract Management. Mr. Harris has written books, articles, marketing collateral, and technical white papers on several products and technologies, including directories, network and Internet security, network protocols, and proxy caching. Mr. Harris has a B.S. in Computer Science and a Masters of Business Administration (MBA).

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Jeff Harris

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Email:

feedback@novellpress.com

Mail:

Mark Taber
Associate Publisher
Novell Press/Pearson Education
800 East 96th Street
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Part I: Open Enterprise Server Overview

[1](#) Introduction to Open Enterprise Server

[2](#) Installing OES for Linux

[3](#) Working with SUSE Linux Enterprise Server 9

[4](#) OES Linux Clients

[5](#) OES Management Tools

Chapter 1. Introduction to Open Enterprise Server

[Instant Access](#)

[Why Open Enterprise Server?](#)

[What Is Open Enterprise Server?](#)

Instant Access

Open Enterprise Server (OES) incorporates the best of both open source and enterprise network operating systems: NetWare 6.5, and SUSE Linux Enterprise Server 9 (SLES), with a common set of services, applications, and management tools. Not only does this provide value to customers, but it keeps them from being locked into a single-technology foundation.

Why Open Enterprise Server?

Novell's Open Enterprise Server (OES) is a secure, highly available information platform that provides powerful networking, communication, collaboration, and application services in an open environment. As network operating systems have become increasingly commoditized, Novell has recognized that the way to provide value to its customers is not to lock them into a single-technology foundation. To that end, OES incorporates the best of both open-source and enterprise network operating systems: NetWare 6.5, and SUSE Linux Enterprise Server 9 (SLES), with a common set of services, applications, and management tools.

With the release of OES, organizations can choose NetWare, SUSE Linux, or a combination of both platforms, as dictated by real business needs. Moreover, common management, directory, and upgrade utilities allow organizations to manage both platforms with a single set of tools, simplifying daily administration.

With OES, Novell demonstrates its commitment to its traditional NetWare customers while embracing the power and new opportunity represented by Linux and the Open Source movement.

What Is Open Enterprise Server?

OES lets you deploy any combination of NetWare-based and Linux-based technologies. Core OES components include

- The NetWare 6.5 Service Pack 3 operating system, and all related NetWare 6.5 services
- The SLES9 operating system, based on the Linux v2.6 kernel, and all SLES9-related services
- The latest Novell Nterprise Linux Services
- Common management tools that allow seamless coexistence and management of the two operating systems

Given that NetWare and Linux are very different operating systems, it's not surprising to find a certain amount of variation between the services available between the platforms. Novell, however, has done an admirable job of providing a common set of core services across both platforms, but there are still specific differences as to some of the services offered on each platform. [Table 1.1](#) lists the major OES services and the platform on which they are offered. As you can see, the majority of services are available on both platforms, so organizations can pick their services and implement them on the platform that makes the most sense in their specific environment. This table also includes references to the part of this book in which each service is discussed.

Table 1.1. Platform Support for OES Services

OES SERVICE	OFFERED ON	COMMENTS
PART I: OPEN ENTERPRISE SERVER OVERVIEW		
iManager	Both	Web-based OES administration console.
Novell Remote Manager	Both	Web-based NetWare and Linux operating-system management console.
iMonitor	Both	Web-based eDirectory monitoring and maintenance console.
Novell Client	Both	Client utility used to access NetWare and Linux NCP services.
NetIdentity	Both	Provides transparent eDirectory authentication.
NetDrive Client	Both	File redirector used to map local drives without the full Novell Client.
NICI Client	Both	Novell International Cryptographic Infrastructure. Provides access to

Chapter 2. Installing OES for Linux

[Instant Access](#)

[Getting Ready for OES Linux](#)

[Installing OES Linux](#)

[Upgrading SLES9 to OES Linux](#)

[Common Post-Installation Tasks for OES Linux](#)

Instant Access

Preparing to Install

- - Ensure that your server hardware meets the minimum requirements of OES Linux:
 - Server-class computer with Pentium II or AMD K7 450MHz processor (Pentium III, Pentium 4, AMD K8, or higher recommended)
 - 512MB of RAM (1GB recommended)
 - 2GB of available, unpartitioned hard disk space (10GB recommended; additional space may be required depending on OES component implementation)
 - 4X CD-ROM drive (48X recommended)
- - Plan out the layout of your OES Linux filesystem, eDirectory tree, and network configuration prior to creating a new OES Linux environment.
- - Prior to implementing OES for Linux on an existing SLES9 server, ensure that you have a full backup and verify that you can recover the data from it.

Configure Installation Source

- - Use netInstall.sh to configure a network-based installation source. This script is available from the following URL:

<http://www.novell.com/documentation/oes/script/netInstall.sh>

- - Export your installation source directory using a network protocol such as NFS, HTTP, or FTP.

Installing OES Linux

- - To install a new SLES9 server with OES, insert the OES CD1 CD-ROM into your server's CD-ROM drive and reboot the server. Follow the subsequent installation prompts.

Upgrading SLES9 to OES

- - Ensure that Linux authentication is set to use local files for authentication rather than OpenLDAP-based LDAP authentication.
- - Ensure that a static IP address and valid hostname and domain name (resolvable in DNS) are configured on the server.

Getting Ready for OES Linux

Whether you are building a new network with OES Linux or installing it into an existing network, there are certain preparations you should make so that the installation goes as smoothly as possible.

For those rare few of you creating a new network from the ground up, you have the opportunity to do all the little things that will make that network easier to manage down the road. Carefully consider your choices of cabling, addressing, naming schemes, access methods, and so forth. As the technical foundation of your network, these are very difficult to change midstream. Consider business factors such as potential company growth, mergers or acquisitions, reorganizations, and all the other business considerations of the twenty-first century. If you don't, your network might lack the flexibility necessary to adapt to strategic and structural changes in your organization.

Unfortunately, the results of all this planning will then have to be weighed against the realities of your budget. There will be inevitable compromises, but this type of advanced planning will make sure those compromises don't come back to haunt you when the network is running.

Server Hardware Planning

Consider the following as you prepare your server hardware for the OES Linux installation:

- - Processor speed The server must have an Intel Pentium II or AMD K7 processor or higher. Novell recommends Pentium III 700MHz or higher processors for multiprocessor servers.
- - CD-ROM drive The server must have an ISO9660-compatible CD-ROM drive. Novell also recommends using a bootable CD-ROM drive compatible with the El Torito specification for booting directly from the CD.
- - Server memory An OES Linux server must have a minimum of 512MB of system memory (RAM).
- - Types of storage adapters and devices The OES Linux installation routine will properly detect most storage adapters and devices, but you should be familiar with the brand and type of your server's storage controllers (SCSI board, IDE controller, and so on), as well as the brand, type, capacity, and other specifications of the storage devices (such as hard disks, CD-ROM/DVD drives, tape drives) attached to those controllers.
- - Size of hard disks OES Linux requires 2GB of unpartitioned space for a basic installation. Odds are that this disk space will seem awfully low if you plan on fully implementing OES Linux. Review your planned installation and ensure that the local disks or shared storage devices are sufficient.
- - Network adapters Know the type of network adapters installed in the server. This should not be necessary, but if the installation routine has trouble identifying your adapters, having this information handy can help resolve the problem quickly. Keep in mind that drivers for unsupported hardware may only be available directly from your third-party vendor. To locate certified hardware, go to <http://www.novell.com/partnerguide/>.
- - Display and input devices An SVGA or better video adapter and monitor along with a standard keyboard and mouse for direct console operation are recommended for use with OES Linux. However, with the powerful web-based administrative tools available with OES, it is possible to operate a "headless" server without any direct input or output devices.
-

Installing OES Linux

Installing OES Linux is a straightforward process, but you should be familiar with several aspects of the installation prior to beginning the process. When you know what to expect, you can begin the process of installing a new server or upgrading an existing server to OES.

The following topics are contained in this section:

- - Preparing to install OES Linux
- - Installing a new OES Linux server
- - Upgrading SLES9 to OES Linux

Preparing to Install OES Linux

Before beginning the OES Linux installation, it is a good idea to double-check the installation prerequisites. This section contains the official prerequisites of an OES Linux server.

It is also important to understand the OES Linux installation patterns. These patterns determine what OES components are installed by default. If necessary, each pattern can be customized to address specific needs.

Finally, creating a network-based installation source is an efficient way to perform multiple installations, or just maintain the installation without relying on the CD media.

When you fully understand these topics, you'll be ready to begin the actual OES Linux installation.

INSTALLATION PREREQUISITES

Before attempting to install OES for Linux, review the following minimum hardware prerequisites list to ensure that your server meets these requirements:

- - Server-class computer with Pentium II or AMD K7 450MHz processor (Pentium III, Pentium 4, AMD K8 or higher recommended)
- - 512MB of RAM (1GB recommended)
- - 2GB of available, unpartitioned hard disk space (10GB recommended; additional space may be required depending on OES component implementation)
- - 4X CD-ROM drive (48X recommended)

Keep in mind that these requirements are specifically referring to the minimum hardware requirements and may not be sufficient for your needs. It is obviously a good idea to use the best hardware available to you, and plan for increased server use in the future.

INSTALLATION PATTERNS

New installations of OES allow you to perform the installation based on one of several different patterns. The

Upgrading SLES9 to OES Linux

In addition to installing a new OES Linux server, it is possible to upgrade an existing SLES9 server to OES. In order to upgrade a SLES9 server, that server must first meet the following requirements:

- - The server must be configured with a static IP address.
- - The server name must be properly registered in DNS.
- - A server certificate must exist for this server, and this certificate must be exported as a "common server certificate."
- - No LDAP daemons can be running on the server. These daemons will conflict with eDirectory and must be disabled.

If the SLES9 server meets these prerequisites, review the "Getting Ready for OES Linux" section earlier in this chapter, and then perform the upgrade to OES by following these steps:

1. Insert the Open Enterprise Server CD1 in the server's CD-ROM drive and restart the server.
2. Begin the OES installation by selecting an installation method as documented in step 2 of the "[Installing a New OES Linux Server](#)" section earlier in this chapter.
3. Read through the license agreement. (The English agreement can be found near the bottom of the page.) When finished, select I Agree to begin the installation.
4. Select the appropriate language for the installation and click Accept.
5. Select Update an Existing System as the type of installation, and then click OK to continue.
6. Select the Update Options category to customize the upgrade process to OES Linux.
7. Select the radio option labeled "Update with Installation of New Software and Features Based on the Selection."
8. At this point, you have the option of selecting one of the previously described OES installation patterns. Select the desired pattern, such as Novell Open Enterprise Server, then click Accept.
9. If prompted for confirmation to reset your detailed selection, select Yes.
10. Click Accept to begin the upgrade process.
11. Click Yes, Update to acknowledge the warning and begin the file copy process. If you are performing a network-based installation, no intervention is required during the file copy. If you are installing from CD, you will be required to swap CDs when prompted.
12. At the conclusion of the file copy process, the server will reboot. When the server restarts, the YaST installation process will resume.
13. Select No to skip the network connectivity test, and then click Next.

Common Post-Installation Tasks for OES Linux

After the installation of OES Linux has been completed, there are a number of tasks you are likely anxious to perform. The majority of these tasks are documented in the relevant chapters of this book. However, there are a few basic tasks that are appropriate to mention here.

The following topics are contained in this section:

- - Verifying your OES Linux installation
- - Post-install OES component configuration
- - Updating OES Linux components using Red-Carpet

Verifying Your OES Linux Installation

Depending on the OES components you selected for installation, there are a number of methods you can use to confirm that the installation was successful. The easiest way to confirm that your OES components are properly configured and started is by accessing the OES Linux Welcome pages.

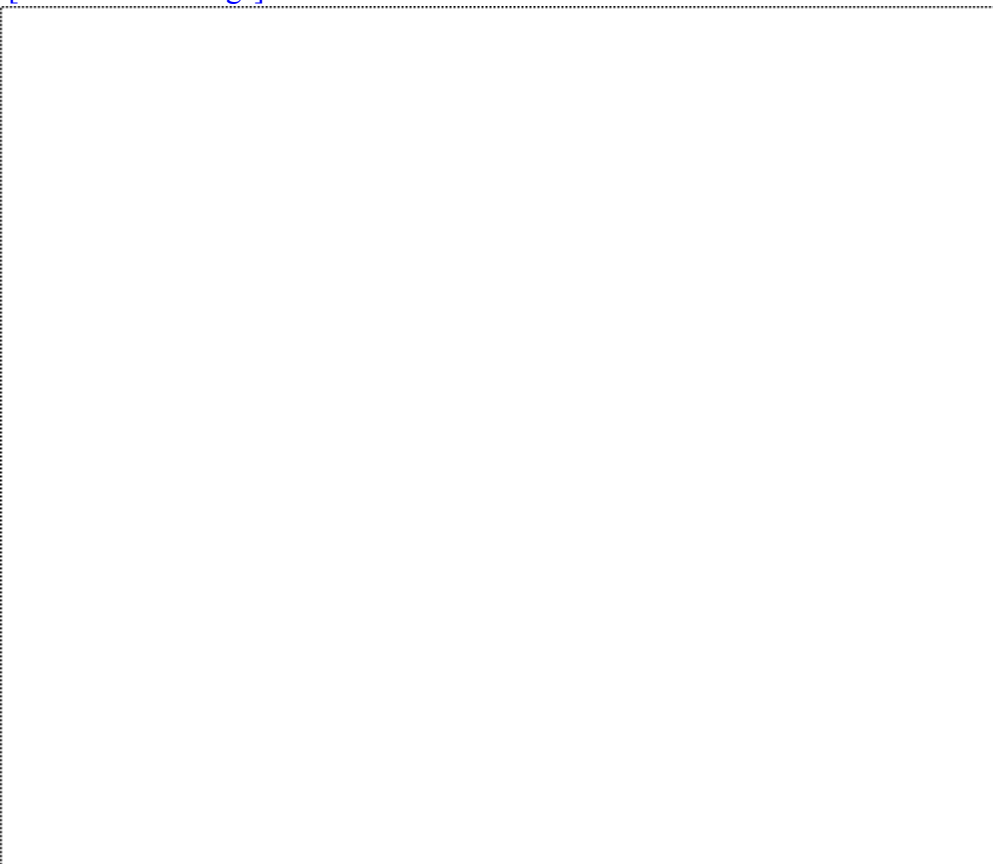
To access the Welcome pages, use a browser to access the following URL:

`http://<OES_Linux_Server_IP_Address_Or_DNS_Name>`

If your OES installation was successful, you should see the Welcome pages as shown in [Figure 2.8](#).

Figure 2.8. OES component Welcome pages.

[\[View full size image\]](#)



Chapter 3. Working with SUSE Linux Enterprise Server 9

[Instant Access](#)

[Logging in to Linux](#)

[The Shell and the GUI](#)

[Finding Your Way](#)

[Getting Help](#)

[Editing Text Files](#)

Instant Access

Working with SUSE Linux Enterprise Server (SLES) requires an understanding of the login process, including local account files, system accounts, and managing identities.

Using a console shell or the graphical environment are two possible methods of working on a SLES machine.

Finding your way around a SLES installation requires an in-depth knowledge of the filesystem layout. Essential filesystem components are documented and explained in this chapter. Basic filesystem permissions are also described.

The SLES help system includes the use of both man and info pages.

Editing text files from a console session is normally done with the vi editor. Modes of vi are explained and tables of common commands used with vi are provided.

Although a complete guide to using SUSE Linux Enterprise Server (SLES) is beyond the scope of this book, an understanding of Linux and basic Linux functionality is necessary for successful deployment of OES Linux.

This chapter will discuss essential Linux concepts, such as understanding the login process, using the command-line and graphical environments, finding your way around the filesystem, using the available help systems, and understanding text-editing tools. Linux-proficient administrators may want to skip to [Chapter 6](#), "SUSE Linux Enterprise Server Management," for more in-depth SLES information, but breezing through this chapter for an introduction to SUSE-specific utilities and environments might be helpful. If you are new to Linux, this chapter should get you started, but this is not intended to be a comprehensive or beginner's Linux guide.

If you'd like a more thorough investigation into Linux fundamentals or SLES administration, Novell Education's Certified Linux Professional (CLP) and Certified Linux Engineer (CLE) programs are well worth looking into. For more information on Novell's SUSE Linux certification options, see [Appendix A](#), "CLE Certification Options."

Logging in to Linux

After installing and booting a SLES server, you should be presented with either a text or graphical login prompt. Entering an appropriate username and password will give you access to the server. For an administrator, it is important to understand how access is granted and how local SLES user accounts are configured. It is also important to have this knowledge prior to implementing OES components such as Linux User Management (LUM). The following section will briefly discuss local user accounts and how the local authentication process works.

Local Account Files

On a SLES9 server, local user accounts are defined in the `/etc/passwd` file as shown in [Figure 3.1](#). Every user defined in this file must have certain attributes that are used by the server for determining such things as user permissions and login name. The format of `/etc/passwd` is one user account entry per line.

Figure 3.1. An example of the `/etc/passwd` file.



Each line within the `passwd` file is made up of five fields, separated by colons. These fields provide the necessary attributes for user accounts to be considered valid by the operating system. The purpose of each field is documented in [Table 3.1](#) for the entry `jdoe:x:1000:100:John Doe:/home/jdoe:/bin/bash`.

Table 3.1. Explanation of `/etc/passwd` EnTRy

FIELD ENTRY	DESCRIPTION
jdoe	User login name.
x	Password field. If an "x" is in this field, shadow passwords are enabled. A "*" in this field prevents most types of local logins.
1000	Numeric User ID (UID) of this account.
100	Numeric primary Group ID (GID) of this account.
John Doe	General Electric Comprehensive Operating System (GECOS) field. Commonly used for the user's full name or description.
/home/jdoe	User's home directory.

The Shell and the GUI

You can interact with SLES by using one of two methods. The first method is the use of a shell or console, and the second method is a Graphical User Interface (GUI). This section will explain and discuss both environments and provide tips for using these two components of SLES.

The Shell

The heart of the SLES operating system is the Linux kernel. The kernel's primary responsibility is to manage running processes and their interaction with the various hardware components of a computer. This includes management of memory (RAM), processors (CPU), hard disks, and other hardware components. Left on its own the kernel manages these components quite well. However, without the guidance of a user or administrator, the kernel certainly will not accomplish much!

For an administrator, the ability to interact with the Linux kernel can be more important than the kernel itself. One important way to facilitate interaction with the kernel is through the use of a "shell."

A shell is a program designed to accept user input, validate that input based on certain criteria (such as syntax and permissions), and then pass instructions off to the kernel for processing. This shell functionality is very similar to the familiar DOS shells under Microsoft Windows environments. Linux shells, however, are much more powerful than traditional non-Unix shells and therefore can be more complex and difficult to master.

One reason for this complexity is the fact that several shells are available for use in Linux environments. Although the purpose of these shells is essentially the same across all variations, the implementations can differ dramatically. These differences are typically manifest in syntax and feature-set capabilities, but each shell can also be substantially different from a usability perspective as well.

[Table 3.7](#) offers a list of some of the shells commonly found in Linux environments.

Table 3.7. Common Linux Shells

SHELL	BINARY PROGRAM	COMMENTS
Bourne Shell (SH)	/bin/sh	The standard command interpreter. On Linux, sh is often a symbolic link to /bin/bash.
GNU Bourne-Again SHell (BASH)	/bin/bash	An improved version of the Bourne Shell. Supports some advanced features of the C and Korn Shells. Excellent shell for new Linux users.
Public Domain Korn Shell	/bin/ksh	An open source version of the Korn Shell. Among other things, supports advanced floating-point arithmetic features.
C Shell	/bin/tcsh	Enhanced version of the Berkley Unix C shell. Features a C programming type of command-line syntax support.
The Z Shell	/bin/zsh	An enhancement of the ksh shell. Features such capabilities as

Finding Your Way

Now that you are familiar with the graphical and console working environments in SLES, you might still find yourself somewhat lost within the environment itself. This section provides an introduction to the filesystem layout and offers an insight into filesystem permissions and potential navigation pitfalls.

System Filesystem

During the system startup process, the Linux kernel loads modules required to access the hard disks into memory. With these modules, physical connections to the hard disk partitions can be established.

Under Microsoft Windows and other operating systems, the filesystem is accessed through drive letters assigned to each individual partition. Linux, on the other hand, provides access to all partitions through a single, virtual directory structure. Accessing separate partitions is a matter of navigating to the correct directory.

The process of associating a partition to a directory within the filesystem is known as "mounting." During system initialization, the partition containing the core operating-system files is mounted to the root (/) of the directory tree. This partition is known as the system or "root" partition.

After root has been successfully mounted, remaining partitions are then mounted to specific directories within the root directory structure. The `/etc/fstab` file is used as a configuration file, which determines where each partition will be mounted. Directories used for mounting filesystems are known as "mount points."

NOTE

When mounting partitions, the destination mount point must exist within the original directory tree. This directory does not have to be empty. Contents of directories used as mount points are inaccessible for the duration of the partition being mounted. Directory contents will again be accessible when the partition using the mount point is unmounted.

[Table 3.11](#) lists the main directories found after a SLES installation and briefly describes their purposes.

Table 3.11. Root Filesystem Components

DIRECTORY	CONTENTS AND PURPOSE
<code>/bin</code>	Commands used by all users.
<code>/boot</code>	Boot-specific files, including the Linux kernel and GRUB configuration files.
<code>/dev</code>	Device files representing possible hardware components.
<code>/etc</code>	Host-specific configuration files.
<code>/home</code>	Home directory for local user accounts.
<code>/lib</code>	Shared library and kernel module directory.
<code>/media</code>	Default mount directory structure for removable media such as CD-ROMs.

Getting Help

SUSE Linux provides literally thousands of possible commands that can be used to perform various tasks on a server. Having firsthand knowledge of each utility and all parameters that utility may take is a very challenging task! Thankfully, through the use of utility manuals and application documentation, help is never too far away.

Console-Based Help

Working on the command line is the most common method of interacting with SLES. Providing easy access to application and utility usage information from this environment is essential to effectively working on the command line. Thankfully, a help system has been designed around just this need. This system consists of three distinct types of documentation: manual or man pages; info pages; and system and third-party documentation.

man PAGES

man pages on Linux are syntax-level documentation of utilities and applications, stored in an easily retrievable, command-line-friendly format. man pages are physically stored in the `/usr/share/man` directory and divided into the nine sections shown in [Table 3.17](#).

Table 3.17. man Page Sections

man SECTION	SECTION PURPOSE
1	Executable programs and commands all users can access
2	System calls
3	Functions and library routines
4	Special device files (<code>/dev/*</code>)
5	Configuration file formats and conventions
6	Games
7	Macro commands and packages
8	System administration programs and commands used by the root user
9	Kernel routines

All programs utilizing the man system should store their man pages within the correct section. In order to view man pages for a specific command, the following basic syntax must be used:

```
man [section] command
```

NOTE

When accessing man pages, specifying the desired section is optional, but the man command satisfies the man page

Editing Text Files

A chapter on working with SLES would not be complete without a discussion on one more important topic editing text files. Although editing text files may not sound like a difficult subject, common tools used when editing text files under Linux tend to be rather cryptic. Devoting some space in this chapter to help clear up confusion in this area should make first-time administrators much more comfortable and effective with any task involving text editing.

The vi Utility

It is possible to use graphical text-editing tools under SLES. Many such tools are easily available in both the KDE and GNOME graphical environments. However, a reliance on graphical editors (such as Kate or Gedit) also produces a dependence on a graphical environment. This graphical environment is often not running on a SLES machine. Also, when using a remote shell for SLES administration, graphical tools require tunneling X over SSH. Rather than enabling this tunneling or always using a graphical session on the server, learning and using a command-line editor is more effective and a better solution for the long term.

As in the graphical environment, several command-line text editors are available. Among the choices for command-line editors are pico, emacs, and vi. Pico and emacs are both powerful text-editing utilities that offer several appealing qualities. However, these utilities are not always available on SLES installations. The vi utility is the only text-editing utility that is nearly guaranteed to be available with any Linux installation.

NOTE

The vi utility on SLES is actually the Vi IMproved, or vim utility. As vim is designed to be compatible to vi, it is still commonly referred to as vi.

The vi utility is an extremely powerful text-editing utility. Unfortunately, the almost limitless capabilities of vi have also caused its usage to become fairly cryptic and challenging for new users. The most important vi concept to understand is that vi operates in a bimodal fashion. Bimodal means that when using vi, you can be in one of two possible modes command mode or insert mode.

The command-mode environment is used for such tasks as performing file operations, copying and pasting text, performing global search-and-replace operations, and working with macros. The insert mode of vi is used for normal text-editing operations. Probably more important than the two modes themselves is the ability to determine what mode vi is currently in!

When vi is initially launched, the interface is left in command mode. It is important to understand that direct file editing is not possible in command mode. Text can be copied and pasted, and various actions such as deleting text can still be accomplished, but adding additional text to the file by typing is not possible. In order to add text to the document, you must first switch to insert mode.

Insert mode is entered by pressing "i" or one of a few other insert text keys. When you are in insert mode, the bottom of the vi window will display the text "INSERT ". Prior to adding text to the file, be sure you are in the correct mode by looking at the bottom of the window for that text. When you're in insert mode, you can switch back to command mode by pressing the ESC key. [Table 3.20](#) lists some of the commands that can be used with insert mode.

Table 3.20. Commands Used to Enter Insert Mode

KEYSTROKE	DESCRIPTION
i	Change to insert mode and place the active cursor before the current character.
I	Change to insert mode and place the active cursor at the

Chapter 4. OES Linux Clients

[Instant Access](#)

[The Traditional Novell Client](#)

[Installing the Client Software](#)

[Removing the Client Software](#)

[Installing from a Web Server](#)

[Upgrading the Novell Client](#)

[The Client Login](#)

[Configuring the Client](#)

[NetIdentity](#)

[Other Novell Clients](#)

[Accessing OES Through Native Linux Methods](#)

Instant Access

The Novell Client and OES Linux

- The Novell Client provides NetWare Core Protocol (NCP) services to client workstations. Used in conjunction with the NCP Server component of OES Linux, the Novell Client allows workstations to log in to eDirectory, map local drives to OES Linux NCP volumes, and seamlessly authenticate to OES services.
- The Novell Client provides a single method of accessing files in mixed NetWare and OES Linux environments.
- The Novell Client is an optional component that is not required for administration of OES Linux.

Installing/Upgrading the Novell Client

- Two Novell Clients are currently available: one for Windows 9x and one for Windows XP/2000. The Novell Client for Linux is expected to become available shortly after OES ships. Novell Client files may be downloaded from <http://download.novell.com> and installed directly, or copied to any convenient location, such as a network server, for installation by any client with existing network access.
- Use the Novell Client Upgrade Agent to periodically check for updated client files. When updated files are found, the Upgrade Agent will automatically start the client upgrade routine.
- If you are upgrading multiple existing Novell or Microsoft clients for OES, you can use the Automatic Client Upgrade (ACU) feature to automate this process. Place ACU commands in a profile or container login script to detect whether the client software needs to be installed, and then the ACU updates the workstation automatically, if necessary, when the user logs in.
- To install the Novell Client from a web server, copy the client files to the web server and use the WriteIP utility to create a SETUPIP executable that will download the Novell Client install files from the web server and launches the client install routine.

Configuring the Novell Client

- After installing the Novell Client, you can configure it by using the Novell Client property pages. Right-click on the red "N" icon in the system tray and select Novell Client Properties.
- To configure the login for a Novell client user, create a login script. Login scripts can be associated with Container, Profile, and User objects. A login script can control what happens when a user logs into your Novell network. For information and syntax on login scripts, see [Appendix B, "The Most Essential Linux Commands."](#)

The NICI Client

- NICI Client v2.2 ships with OES NetWare. The NICI client (Novell International Cryptographic

The Traditional Novell Client

The Novell Client installation program automatically copies all necessary client files to the workstation and edits any configuration files that require modification. Although the Novell Client is required for OES NetWare and mixed environments, OES Linux does not require the Novell Client for full administrative capabilities.

You can choose one of three methods for installing the Novell Client on your workstation:

-

Download and install the Novell Client from <http://download.novell.com>. Periodically, Novell releases updated clients with new features, so the client files on the Internet may be newer than those versions described here. It's a good idea to check this location occasionally for updates.

-

Install the Novell Client from a web server.

-

Upgrade existing workstations with the Novell Client Update Agent.

Novell offers a Novell Client for Windows XP/2000 (currently v4.91) and for Windows 9x (currently v3.4). The installation procedure for both versions is identical, so you can use the installation, configuration, and removal instructions regardless of the version of Windows you are running.

Novell is also nearing completion of development on a Novell Linux client for Linux workstations. Although complete details were not available at the time of writing, this new client is expected to bring many of the client features so important to Windows users to the Linux platform as well. Release of the Linux client is expected to be shortly after the shipping of OES.

For either Windows platform, if you are installing a new client, you should have an Internet connection to access the Novell client install files. If you're upgrading an existing workstation that already has a connection to the network, you can run the installation program from a network directory instead.

Installing the Client Software

To install the Novell client software on a Windows workstation from an OES Linux server, download the latest client from <http://download.novell.com> and complete the following steps:

NOTE

You can use the following procedure whether you're installing a new network workstation or upgrading an existing one. If you are upgrading an existing workstation, the installation program will detect existing settings (such as the protocol used, the network card, and optional features) and use those same settings as the default settings for the upgraded workstation.

1. (Conditional) If necessary, install a network card in the workstation according to the manufacturer's documentation and connect the work-station to the network. It's a good idea to record the card's configuration settings, such as its interrupt and port address.
2. (Optional) If you are planning to upgrade a workstation and want to run the installation program from the network, create a directory called CLIENT under SYS:PUBLIC, and extract the contents of the Novell Client ZIP file to the newly created network directory.

NOTE

With OES Linux, the NCP Server component is required for hosting a client upgrade directory for workstations. This directory must exist beneath the NCP exported SYS volume. On an OES Linux server, the full path to the SYS volume is /usr/novell/sys. The CLIENT directory must have Read and Execute rights to the directory so that users can locate the installation files. For more information on file system rights, see [Chapter 11](#), "OES Linux File Storage and Management."

3. Run SETUPNW.EXE (Windows XP/2000) or SETUP.EXE (Windows 9x).
4. Specify either Typical or Custom installation and click Install. If you select Custom, continue with step 8. If you choose Typical installation, skip to step 13. The Typical installation configures the Novell client as follows:
 - The Typical installs only the Novell client files, the NICI client, and the NMAS client. If you want to install optional components such as NDPS, Novell Workstation Manager, and ZENworks Application Launcher, use the Custom installation.
 - Both IP and IPX protocols.
 - Directory-based authentication (eDirectory).
5. Select the client components you want to install and click Next. If the installation program detects that any of these options are already installed on this workstation, those options will be checked.
6. Select the additional products you want to install, and click Next:
 - Novell Modular Authentication Services (NMAS) The NMAS client provides advanced authentication options to the standard Novell Client. The NMAS client is discussed later in this chapter.
 - NetIdentity Agent The NetIdentity agent automates authentication to popular Novell services. NetIdentity is discussed later in this chapter.

Removing the Client Software

To remove the Novell client software from a Windows workstation, use the Network control panel. The Novell Client uninstall will remove all client components from the workstation, but will leave behind a minimal footprint in the Windows Registry. That way, if you reinstall the client at a later time, the installation program can automatically load the same settings that were used previously.

To remove the Novell client from Windows XP/2000, complete the following steps:

1. Open the Network control panel by right-clicking My Network Places and selecting Properties.
2. Right-click Local Area Connection and then select Properties.
3. Select the Novell Client for Windows entry from the list of installed network services and click Uninstall.
4. Click Yes to confirm your decision.
5. Reboot the workstation to complete the client removal.

To remove the Novell client from Windows 9x, complete the following steps:

1. Open the Network Control Panel applet by selecting Start, Settings, Control Panel and then selecting Network. Alternatively, you can access this utility by right-clicking Network Neighborhood.
2. Select Novell NetWare Client from the list of installed network services and click Remove.
3. Click Yes to confirm your decision.
4. Reboot the workstation to complete the client removal.

NOTE

You can also remove the client from the Control Panel by selecting the Add/Remove Programs option, selecting Novell Client for Windows, and then clicking Remove. You will still have to reboot to complete the removal of the client software.

To remove the Novell client from Windows 9x, complete the following steps:

1. Open the Network Control Panel applet by selecting Start, Settings, Control Panel and then selecting Network. Alternatively, you can access this utility by right-clicking Network Neighborhood.
2. Select Novell NetWare Client from the list of installed network services and click Remove.
3. Click Yes to confirm your decision.
4. Reboot the workstation to complete the client removal.

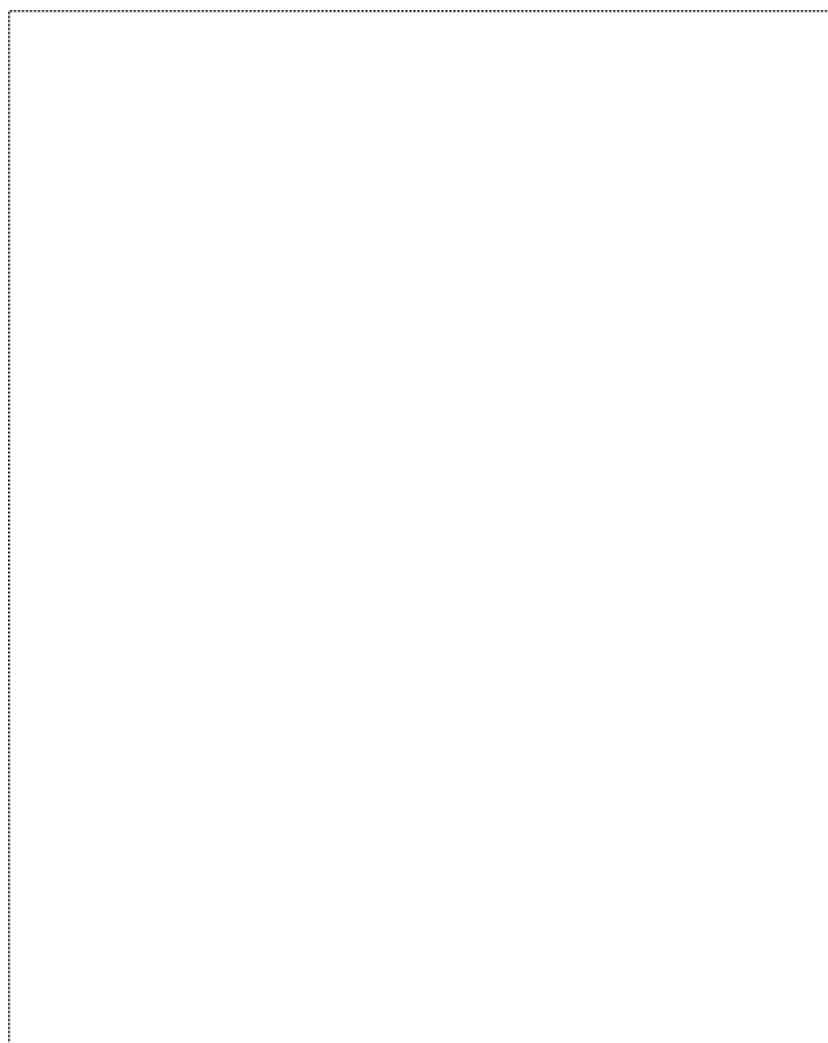
When the workstation has rebooted, the removal of the Novell client is complete.

Installing from a Web Server

You can now set up a Novell client installation from any web server by completing the following steps:

1. Copy the complete \WINNT or \WIN95 directory structure to the desired location on the web server. This structure is created when you extract the Novell Client files from the ZIP file downloaded from <http://download.novell.com>. You can place the files on up to five web servers in order to provide faster access.
2. From a Windows workstation, run WRITEIP.EXE. Using the WriteIP utility, you can create a small executable called SETUPIP that downloads the Novell client install files from a web server IP address and launches the Novell client install routine. There are versions for both Windows 9x and Windows XP/2000, and for all supported Novell Client languages:
 - Windows XP/2000 WRITEIP.EXE is located in \WINNT\i386\admin.
 - Windows 9x WRITEIP.EXE is located in \WIN95\IBM_<lan>\ADMIN\ where <lan> is one of the languages supported by the Novell Client.
3. In the WriteIP utility (see [Figure 4.1](#)), provide the necessary information and click OK.

Figure 4.1. The WriteIP utility is used for creating a setup application for installing the Novell Client from a web server.



-

Specify the IP address(es) or DNS name(s) of the web server(s) that host the Novell client files, and

Upgrading the Novell Client

There are a couple of options for upgrading workstations with existing Novell Client installations. You have the option of automatically checking for updates, and running fully or partially automated upgrade routines for your users, depending on their needs.

Novell Client Install Manager

The Novell Client platform-specific installation utilities each read a configuration file in order to properly install and configure the various properties of the client. This file is stored in the same folder as the installation utility, and provides information such as where to copy drivers during installation and the most recent version number. This configuration file is configurable through the Novell Client Install Manager (NCIMan).

NOTE

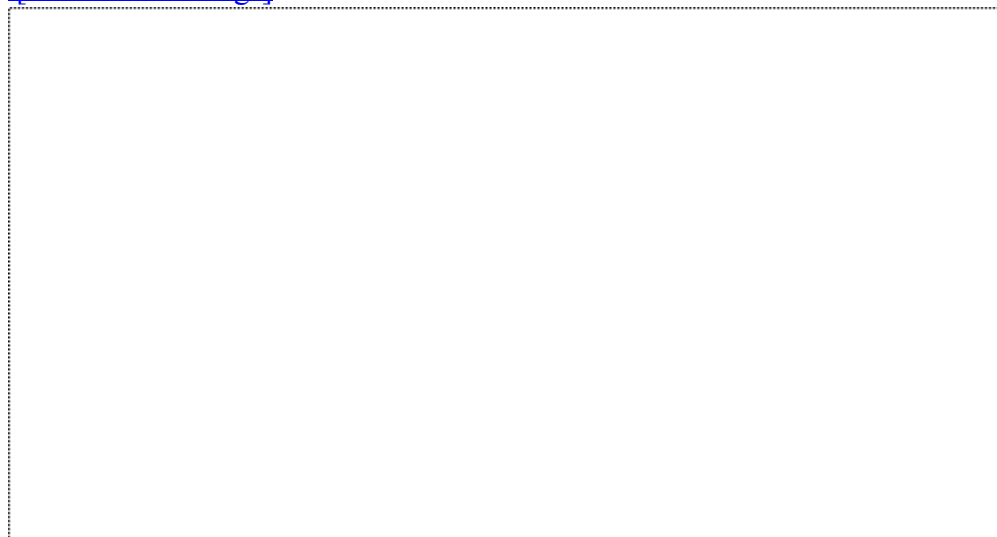
For Windows 9x workstations, options that were previously stored in NWSETUP.INI or were made available from the command line in previous versions of Novell Client are now configured through NCIMan.

To create or modify a configuration file with NCIMan, complete the following steps:

1. Copy the complete \WINNT or \WIN95 directory structure to the server from which users will access the client files. This structure is created when you extract the Novell Client files from the ZIP file downloaded from <http://download.novell.com>.
2. Launch Novell Client Install Manager (see [Figure 4.2](#)):
 - Windows XP/2000 NCIMAN.EXE is located in \WINNT\i386\admin.
 - Windows 9x NCIMAN.EXE is located in \WIN95\IBM_<lan>\ADMIN\ where <lan> is one of the languages supported by the Novell client.

Figure 4.2. NCIMan utility from the Novell Client.

[\[View full size image\]](#)

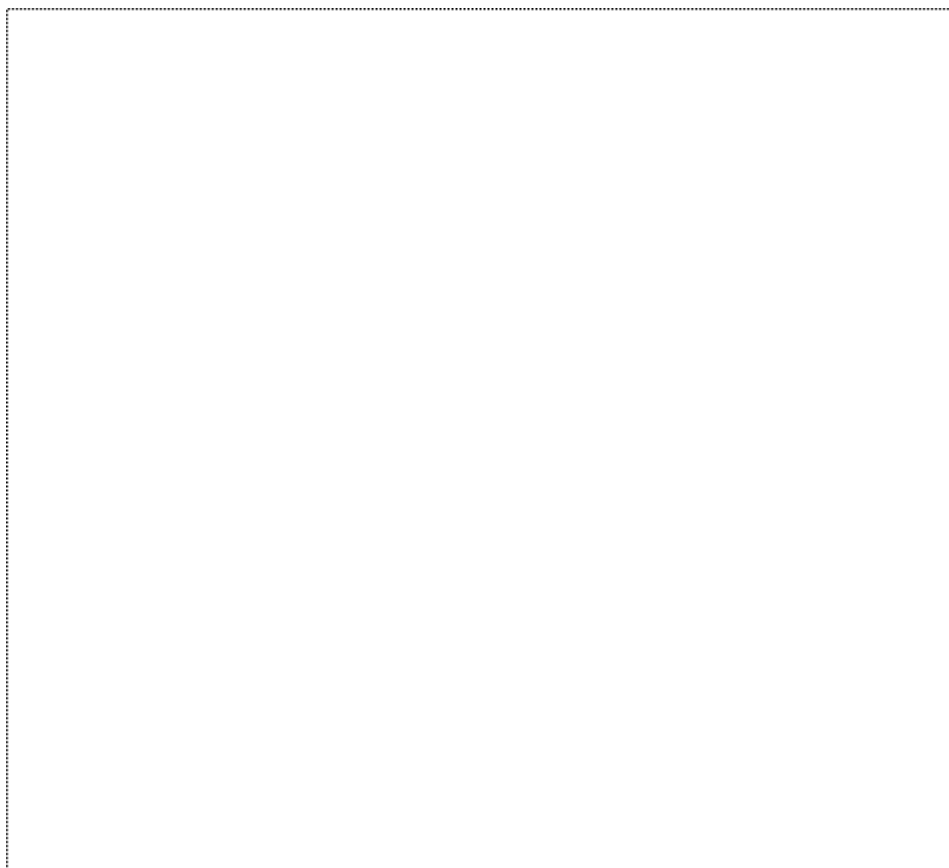


3. Click the New button.
4. Specify the platform for which you are creating a configuration file and click OK.

The Client Login

When the Novell client has been installed, you can view and set login options from the Novell Login by clicking the Advanced button, as shown in [Figure 4.6](#).

Figure 4.6. Novell client login screen showing the Advanced options.



NOTE

The Windows tab, not shown in [Figure 4.6](#), is only available prior to logging in to Windows. From this tab, you can specify the Windows username and workstation name that will be used by the Novell Client to transparently log you in to the workstation as part of the Novell login process.

NDS Tab

The NDS tab, as shown in [Figure 4.6](#), allows you to specify the eDirectory tree, name context, and server to use during login. All users should specify their eDirectory tree and name context. A server needs to be specified only when connection to a NetWare 3 server is needed or when you are trying to log in to a specific server. When logging into a specific Linux server, that server must be running OES. In order to map drives to that Linux server, the NCP Server OES component must also be installed.

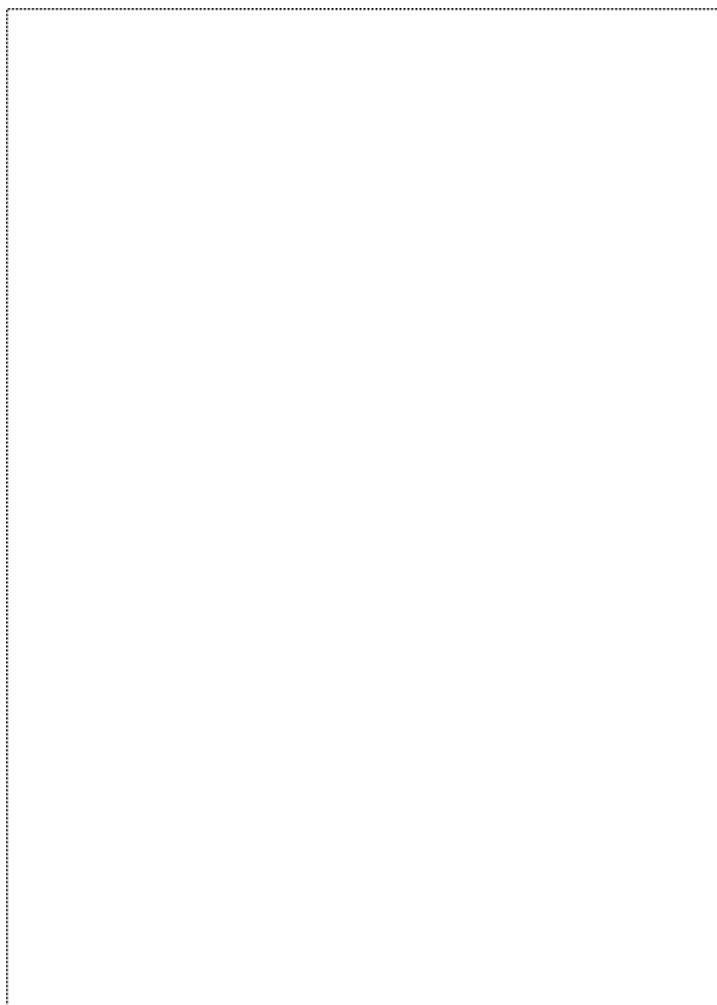
Script Tab

The Script tab (see [Figure 4.7](#)) is used to manage the execution of login scripts. It allows you to specify whether or not to run scripts; whether or not to display the login results window (and close it automatically); and which profile and user login scripts to execute. The Variables button allows you to specify values for any script variables that might be included in the login scripts.

Configuring the Client

After you have installed the Novell client software, you can configure the client software by modifying its properties. The client properties enable you to specify information such as login preferences, protocol settings, default capture settings, and so on. To open the client property pages, right-click the red N icon in the system tray and click Novell Client Properties, which will open the Novell Client Configuration options (see [Figure 4.10](#)).

Figure 4.10. Configuration options for the Novell Client.



Several configuration pages are available in Novell Client properties. For detailed information on Novell Client property pages, see the online OES documentation.

- Client The Client page lets you define basic login preferences, similar to the NDS tab in the Novell Login screen.
- Location Profiles Location profiles allow you to save a specific login configuration so that users don't have to enter login information manually. Location profiles are especially powerful for users who log in from multiple locations (such as the office, home, laptop, and so on).
- Advanced Login Advanced Login options let you hide certain aspects of the Novell Login screen to prevent users from making changes.
-

NetIdentity

The NetIdentity agent leverages what is known as the XTier framework used with NetStorage, Apache, and Tomcat services to provide single sign-on across all Novell services that use eDirectory authentication. The only caveat to this is that the first service with which a user authenticates must be NetIdentity-enabled. The list of NetIdentity-enabled services includes the following:

- - Novell Client (v3.4x for Windows 9x and v4.9x for Windows XP/2000)
- - iFolder 2.x
- - iPrint
- - NetStorage
- - Novell Portal Services

When you have authenticated with one of these services, accessing any other service, such as iManager, that uses eDirectory authentication will prompt a transparent, background authentication so that you aren't required to re-enter your authentication information.

To enable NetIdentity-based single sign-on to Novell services, complete the following tasks:

- - Make sure that the XTier framework is installed on all OES NetWare servers to which users will authenticate.
- - Install the NetIdentity Agent on the workstation where you want NetIdentity services enabled.

The XTier framework is installed automatically when you install NetStorage, Apache, and Tomcat services. It cannot be selected and installed separately, so if you want to use NetIdentity, install one or more of these services on your OES Linux server prior to continuing. If you are unsure if XTier is installed on a given server, point your browser to the following URL:

`http://<server IP or DNS name>/oneNet/xtier-login`

If XTier is installed you will see an authentication dialog box, indicating that the server can recognize credentials passed by NetIdentity.

To install the NetIdentity Agent, complete the following steps:

1. Locate the \netidentity folder created when the Novell Client files are extracted from the ZIP file downloaded from <http://download.novell.com>. For example, for Novell client for Windows XP/2000, the NetIdentity folder is located in \WINNT\i386\.
2. Run SETUP.EXE located in the \netidentity folder.
3. Select the Installation language and click OK.

Other Novell Clients

In addition to the traditional Novell client, there are three other clients compatible with OES Linux. They are as follows:

- NICI client
- NMAAS client
- NetDrive client

In addition to these three feature-specific clients, there are a few others that are installed automatically with their respective product software. Each of these clients will be discussed as part of its product overview in other chapters throughout this book.

NICI Client

The Novell International Cryptographic Infrastructure (NICI) is the modular foundation for all crypto-services offered in Novell products and services. NICI client provides cryptographic services to client-side applications and services. NICI client has received FIPS 140-1 (Level 1) certification, which is as good as it gets for client-based cryptographic services.

The NICI client is included with the Novell Client download, available from <http://download.novell.com>. In an OES NetWare environment, the NICI client is required for several components, including Deployment Manager, Novell Nsure Audit, and Native File Access. With OES Linux, the only components that require the NICI client are the Novell Modular Authentication Service and ConsoleOne (when downloaded and installed on a local Windows workstation).

The NICI client is installed automatically as part of the Novell Client installation process, discussed earlier. It can also be installed separately by completing the following steps:

1. Locate the \nici folder created when the Novell Client files are extracted from the ZIP file downloaded from <http://download.novell.com>. For example, for Novell client for Windows XP/2000, the NICI folder is located in \WINNT\i386\.
2. Launch WCNICIU0.EXE from the \nici folder.
3. At the NICI client Welcome screen, click Next.
4. At the License Agreement screen, click Yes.
5. At the Setup Complete screen, click Finish.

This completes the installation of the NICI client.

NMAAS Client

Novell Modular Authentication Services (NMAAS) allow you to supplement or replace the traditional Novell password authentication mechanism with alternative mechanisms such as SmartCards, tokens, and biometrics. OES Linux includes the NMAAS Starter Pack, which offers two alternative authentication methods. NMAAS Enterprise Edition, which is sold as an add-on product, adds support for many third-party authentication methods, multifactor

Accessing OES Through Native Linux Methods

In addition to accessing files through the OES NCP Server, clients can easily access the OES Linux filesystem through several native Linux methods. The two most common options for remote file access are the Network File System and Samba.

Network File System (NFS)

The Network File System (NFS) was originally created to provide for seamless disk access across a network. Through the use of an NFS server, local disk contents are exported to NFS client machines. NFS clients then access the NFS directories as though they were physically on the local disk.

SLES includes both client and server components of NFS. Although providing NFS access to the local disks is not required when using the NCP Server, it is sometimes useful or necessary to provide NFS access to clients. The following section will briefly describe the server configuration and client access methods required by NFS.

CONFIGURING NFS ACCESS

Configuring NFS file access on SLES is performed using the YaST management utility. YaST is discussed in detail in [Chapter 6](#), "SUSE Linux Enterprise Server Management." To configure NFS, the "NFS Server" module within YaST's Networking Services section must be used.

The NFS Server module first prompts for enabling or disabling the server. If the server is enabled, the next screen allows for configuration of local directories for NFS export. To export a directory properly, the following components must be filled out:

- - Directory Absolute path of a local directory must be entered for proper functioning on the NFS server.
- - Hosts Wildcard Representation of clients that are allowed to connect to the current exported directory. A valid hosts list can consist of a set of asterisks (*) to indicate all clients or a specific IP address to represent a single client. Ranges of IP addresses and DNS names are also valid entries.
- - Options The options list of an NFS export is used to configure the permissions of that export. Common options include ro for read-only access, root_squash for disabling root access to the export, and sync for enabling synchronize file access.

NOTE

For more information on host wildcards and export options, see `man 5 exports`.

Upon completing the NFS Server configuration module, the NFS server is started automatically and clients can begin accessing NFS exports.

MOUNTING AN NFS EXPORTED DIRECTORY

When a SLES directory has been exported for NFS clients, it is imported into a remote filesystem for access. Linux systems use the mount command to accomplish this. To mount an exported directory on a Linux system, complete the following steps:

1. Use the `mkdir` command to create a directory that will hold the OES Linux NFS export, for example: `mkdir /OESFiles`.

Chapter 5. OES Management Tools

[Instant Access](#)

[Welcome Pages](#)

[ConsoleOne](#)

[iManager](#)

[Novell Remote Manager](#)

[iMonitor](#)

Instant Access

Welcome Pages

- OES Linux Welcome Pages provide an introduction to OES components and links to administrative and user-level tools. You can access these Welcome Pages using a web browser to connect to the IP address or DNS name of the OES Linux server. For example:

`http://www.quills.com`

or

`http://192.168.1.100`

ConsoleOne

- ConsoleOne is a Java-based tool for managing your network and its resources. Although not shipped as part of OES Linux, ConsoleOne for Linux, and several other platforms, it can be downloaded from <http://support.novell.com>.
- ConsoleOne is not capable of managing all components of OES Linux. However, some administrative tasks (such as eDirectory administration) can still be performed via ConsoleOne.

iManager

- iManager provides role-based management of your OES Linux network, together with a nearly comprehensive set of administrative tools. When you've loaded iManager, you will use it to perform most of the day-to-day administrative tasks in your OES environment, including management of most services that are available with OES Linux.
- You can access the iManager web page by appending the iManager path (</nps/iManager.html>) to the IP address or DNS name of the server running iManager. For example:

`https://www.quills.com/nps/iManager.html`

or

`https://192.168.1.100/nps/iManager.html`
- To force iManager into Simple mode to support Federal accessibility guidelines, use the Simple mode path (</nps/Simple.html>). For example:

`https://www.quills.com/nps/Simple.html`

or

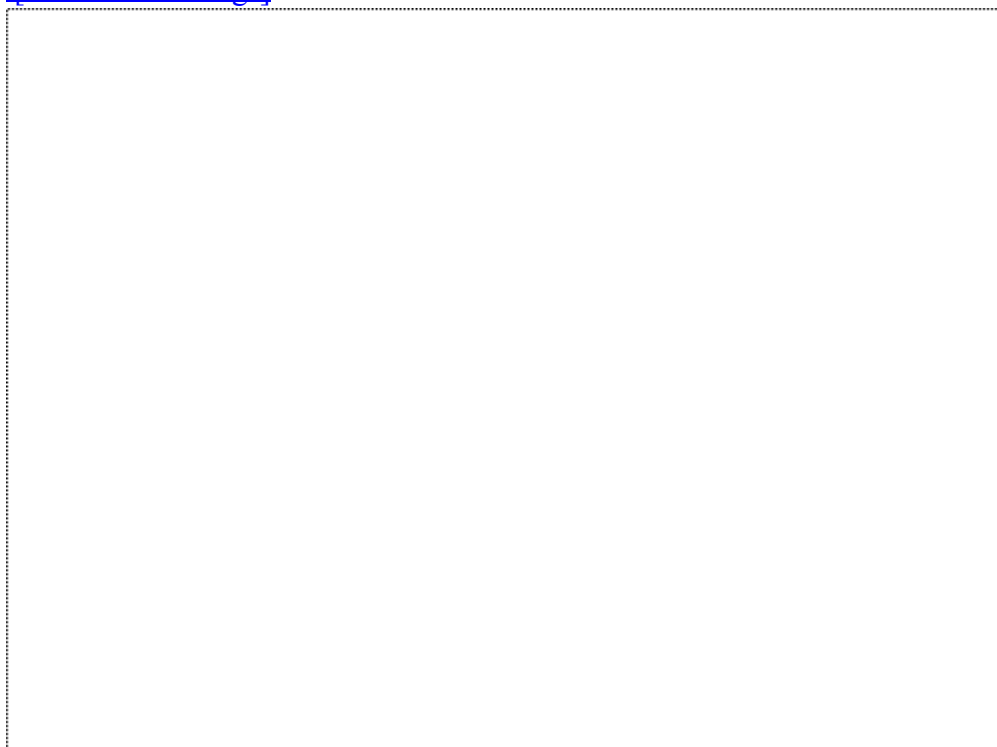
`https://192.168.1.100/nps/Simple.html`
-

Welcome Pages

Prior to discussing the various administrative tools themselves, there is one important OES Linux tool to point out the OES Linux Welcome Pages. These pages, shown in [Figure 5.1](#), are a collection of introduction pages for each OES Linux web-based utility. These utilities are both administrative utilities, such as iManager and NRM, and user-level utilities, such as Virtual Office and NetStorage.

Figure 5.1. The OES Linux Welcome Pages.

[\[View full size image\]](#)



To view the OES Linux Welcome Pages, use a web browser to access your OES Linux server's IP address or DNS. For example:

`http://www.quills.com`

or

`http://192.168.1.100`

The Welcome Pages are made up of two frames. The left-hand frame is the navigation frame and contains links to all Welcome Pages divided into five categories. Beneath each category are links to introduction pages for specific utilities. Selecting one of these utilities opens the appropriate introductory page in the right-hand frame of the Welcome Pages.

Welcome Page categories and introductory pages found within each category are described in the following list:

- End User Software This category contains introductory pages that end users may be interested in, including iFolder, iPrint, NetStorage, QuickFinder, and Virtual Office. Also included in this category is an introductory page for Novell eDirectory.

ConsoleOne

ConsoleOne is a Java-based tool used for managing your eDirectory-based network and resources. ConsoleOne has been an important tool for the last several versions of NetWare, and has also been provided for standalone versions of eDirectory on Linux.

Natively, ConsoleOne provides support for basic management of eDirectory and core eDirectory objects (such as users, groups, and servers). As additional products are added to an eDirectory network, the eDirectory schema is extended to provide support for new object classes and attributes. In order for ConsoleOne to recognize these new objects, a corresponding product-specific snap-in is required.

OES Linux provides a number of new components that do not have a corresponding ConsoleOne snap-in. Because of this, OES Linux does not include ConsoleOne. However, for basic eDirectory administration, ConsoleOne v1.3.6c can be downloaded from <http://support.novell.com>. Downloadable versions are available for Linux, Windows, NetWare, and Solaris. ConsoleOne running on any of these platforms may connect to and manage eDirectory objects on OES Linux.

It is important to remember that ConsoleOne cannot be used to manage every component of OES Linux. Existing infrastructures employing eDirectory can continue to use ConsoleOne for eDirectory administration, but comprehensive OES Linux management is only available through iManager. Additional information regarding ConsoleOne is available through the online OES documentation.

iManager

OES Linux includes iManager 2.5, a web-based tool for administering, managing, and configuring OES components, services, and eDirectory objects. iManager allows Role Based Services (RBS) to give you a way to focus the user on a specified set of tasks and objects as determined by the user's role(s). What users see when they access iManager is based on their role assignments in eDirectory.

iManager has been architected to leverage Novell's exteNd web services platform, and is in effect a management portal for Novell's products and services. It runs on Apache Web Server. For more information on Apache Web Server, see [Chapter 14](#), "OES Web Foundations."

Although other management tools, such as ConsoleOne, can be used to administer specific components of OES Linux, nearly all management tasks can be done through iManager. Among other things, you can define management roles to administer Linux User Management (LUM), iPrint, iFolder, IP address management, and perform eDirectory object management. iManager is the preferred management platform for OES Linux.

Installing iManager

In some OES Linux installations and patterns, iManager will not be installed automatically. If you did not select to install iManager during the server installation, it can be manually reinstalled through YaST, or the command line. To install iManager via YaST, complete the following steps:

1. Access YaST from a terminal using `yast`, or from a graphical environment using `yast2` or the YaST launcher from the application menu.
2. Select the Network Services category in YaST. From within this category, locate and select the iManager module. This module will detect that the RPMs for iManager are missing and ask if you want to install them. Select Continue to install the necessary packages.
3. At the conclusion of the software installation, SuSEconfig is executed to update the system configuration. When this completes, the configuration of the iManager will begin automatically.
4. At the iManager Configuration screen, enter the following information and click Next:
 - eDirectory Tree Enter the name of the eDirectory tree iManager will be servicing.
 - FDN Admin Name with Context Enter the eDirectory administrators credentials using fully qualified dot notation, for example, `cn=admin.o=novell`.
5. The iManager configuration is now saved, and necessary iManager plug-ins are automatically installed. Depending on the OES components installed, this step can take some time.
6. In order for iManager to be active, select to restart Apache and Tomcat when prompted.

When you've installed iManager, you can open it from its URL, using either HTTP or HTTPS, at `<server IP address>/nps/iManager.html`. You will be required to authenticate in order to access iManager, and will have access to only those features to which you have rights. For full access to all iManager features, authenticate as a user with Supervisory rights to the eDirectory tree (see [Figure 5.2](#)).

Figure 5.2. The iManager 2.5 home page.

[\[View full size image\]](#)



Novell Remote Manager

Another essential management tool with OES Linux is the traditional NetWare utility Novell Remote Manager (NRM). In a NetWare environment, NRM combines the functionality of the console Monitor utility, together with functionality from several other console utilities, and NRM makes it available from a web browser. With OES Linux, NRM brings this same ease of web-based server administration to Linux!

You can use NRM to monitor your server's health, change the configuration of your server, and perform diagnostic and debugging tasks. The following list outlines some of the major tasks you can perform with NRM:

- Manage server health Monitoring the health status of one or more servers, building groups of servers to monitor including servers not running OES
- Configure server environment Viewing information about kernel modules, hardware resources, disk partitions, and processor(s); viewing and managing running processes; monitoring server memory and swap statistics; accessing and uploading files on local partitions; managing, installing, and removing software packages; and shutting down, restarting, or resetting a server
- Troubleshoot server problems by Finding CPU hogs, finding high memory users, locating server process hogs, finding disk space hogs

Primary features of NRM include the following:

- Logging in When you point your browser at NRM, you will be prompted to authenticate before seeing any pages.
- Health Monitoring Notification Health aspects of the server, including memory, swap, and disk partition statistics, can easily be monitored. Thresholds for warning notifications can then be set to ensure that action is taken for critical situations.
- Software package management Software packages can be managed, removed, and installed directly from the NRM interface.
- Process management All running processes, and memory and CPU resources they are consuming, can be quickly viewed and sorted in several manners. Rogue processes can be killed from this same interface.

NRM is a very robust management utility that promises extremely flexible operation for OES administrators.

Accessing NRM

With most installations and patterns for OES Linux, NRM is installed automatically. After the installation, use a web browser from a client computer in your network to access the NRM interface. In order to access NRM from an Internet connection outside your firewall, you will need to make sure that TCP port 8009 is opened through the firewall to the IP address of your web server. Port 8009 is the default port through which you will access the NRM interface. If you like, this port can be changed as long as it doesn't conflict with any other service on the OES server.

To use NRM, you must use a web browser such as Konqueror or Mozilla on a Linux workstation, or Internet Explorer or Netscape Communicator on a Windows workstation. Make sure that Java or JavaScript is enabled on your web browser.

iMonitor

OES Linux ships with iMonitor v2.3. The goal of iMonitor is to provide a web-based alternative, and eventual replacement, for many of the traditional eDirectory management and troubleshooting tools such as DSBrowse, DSTrace, DSDiag, and much of DSRepair.

iMonitor is capable of gathering information not only from OES servers, but from most any version of eDirectory, including NDS version 4.11 or higher, and NDS or eDirectory running on any supported platform (NetWare, Windows NT/2000, Solaris, Linux, and Tru64).

Although iMonitor does provide tree-wide management, it is designed to get "down in the weeds" just like the console-based tools that you may have used in the past. It keeps track of the activities of the DSAgent running on each eDirectory server, so you can get an accurate picture of what is happening at any given time.

The following list identifies some of the major features offered by iMonitor in OES:

- - General eDirectory tasks This category of features includes search for eDirectory object(s), status of DirXML in your environment (if applicable), both preconfigured and customizable eDirectory reports, and detailed eDirectory error code and troubleshooting references.
- - Monitor eDirectory agent health This includes synchronization status, detailed synchronization information, known eDirectory servers, and partition and replica status for this server.
- - Browse eDirectory agent This feature lets you view eDirectory objects and attributes from the perspective of the server as well as viewing eDirectory schema on the server.
- - Configuring eDirectory agent Configure partition lists, replication filters, background processes, agent triggers, login settings, schema and partition synchronization, and database cache settings.
- - Server-centric tasks This includes web-based versions of DSTrace, simplified DSRepair, and a background process scheduler. These services are available only for the server from which iMonitor is running.

As you can see, much of what was previously accomplished by console-based tools is now available via the web-based interface of iMonitor.

Installing iMonitor

iMonitor is installed automatically during the installation of OES Linux. Because it shares resources with NRM, the httpstkd daemon must be loaded on the server in order to access iMonitor. The novell-httpstkd daemon is started in runlevels 2 through 5 to accomplish this.

After the installation, use a web browser from a client computer in your network or from the server itself to access iMonitor. To access iMonitor from an Internet connection outside your firewall, you will need to make sure that TCP port 8030 is opened through the firewall to the IP address of your web server. Port 8030 is the default port through which you will access the Web Manager interface. If you like, you can change this port as long as it doesn't conflict with any other service on the OES NetWare server.

To use iMonitor, you must use a web browser such as Konqueror or Mozilla on a Linux workstation, or Internet Explorer or Netscape Communicator on a Windows workstation. Make sure that Java or JavaScript is enabled on your web browser.

Part II: Open Enterprise Server Infrastructure

[6](#) SUSE Linux Enterprise Server Management

[7](#) Novell eDirectory Management

[8](#) Users and Network Security

[9](#) OES Clustering Services

[10](#) Identity Manager Bundle Edition

Chapter 6. SUSE Linux Enterprise Server Management

[Instant Access](#)

[SLES Startup Procedures](#)

[Interacting with Processes](#)

[Introduction to Linux Kernel Management](#)

[Managing SLES with YaST](#)

[Updating OES Linux](#)

[Monitoring SLES with Health Monitoring Services](#)

[Troubleshooting](#)

Instant Access

- Effective management of a SLES environment requires a working knowledge of the SLES startup process, including an understanding of the GRUB bootloader configuration and all boot-related files.
- Processes can be administered through the use of signals and process-related commands.
- Kernel and kernel module management involves understanding the contents of the /boot directory and configuration files found in the /etc directory.
- SLES administration is centrally located in the YaST command-line or graphical utility. All major SLES components can be managed via this interface.
- Although command-line editing of configuration files can often be used to accomplish administrative tasks, SuSEconfig may overwrite changes unless those changes are performed via YaST.
- System updates must be installed via the Red-Carpet software management system after installing OES. Using the YaST Online Update module can result in an inoperable server!
- Effective troubleshooting of SLES should involve the use of log files found within the /var/log directory. If additional investigation is required, Rescue Mode and a large number of additional investigative tools are available.

SLES administration is a broad and complex topic. This chapter will discuss core server administration tasks and important OES component administration concepts. Specifically, this chapter will cover the system startup process, process management, system logging facilities, and kernel management concepts. SLES and OES component administration through the YaST utility, and software installation options will also be discussed.

In addition to the administration concepts mentioned here, there are many other Linux topics you may be interested in exploring. Novell Education has several Linux-specific programs that will provide a more comprehensive insight into Linux administration. For more information on Novell's SUSE Linux certification options, please see the Novell Education website at <http://www.novell.com/education>.

SLES Startup Procedures

After you power on your SLES server, the operating system is initialized and background services (including OES daemons) are started prior to the server providing a login prompt. As an administrator, it is important for you to understand the process your SLES server follows to bring the server up to this usable state.

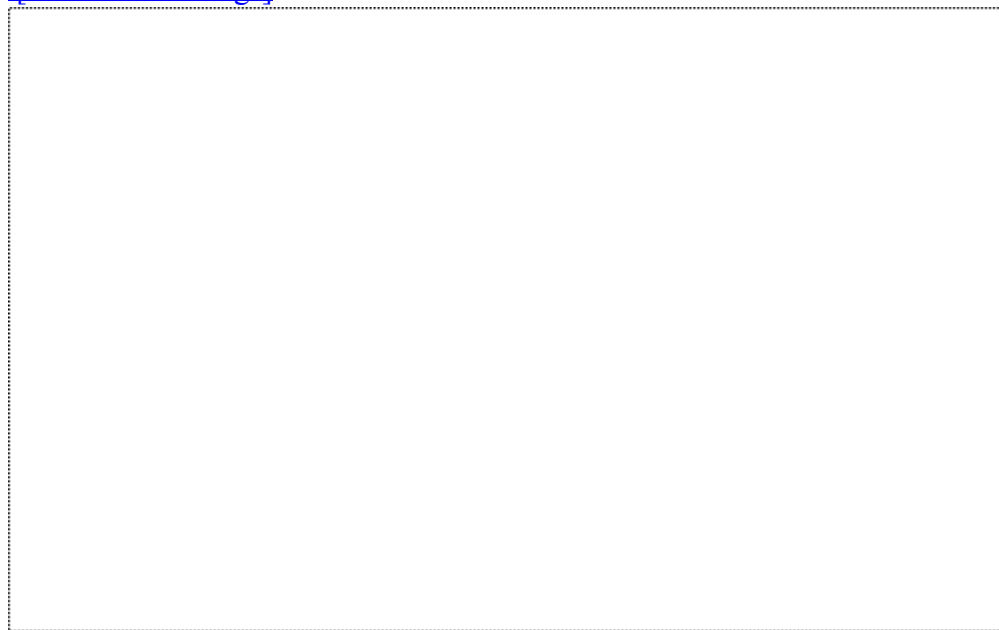
Bootloader Configuration

By default, a SLES9 installation uses the GRand Unified Bootloader (GRUB) to load the Linux kernel into memory. GRUB performs this task by writing a loader program to the Master Boot Record (MBR) of the first hard disk in the computer system. Following the computer's Power-On Self Test (POST) process, GRUB will be initialized and able to load the appropriate Linux kernel into memory.

GRUB employs a dual-stage loader process in which the configuration of GRUB itself is stored on the local filesystem under the `/boot/grub` directory. This directory is known as the GRUB Root Partition and contains the configuration files used by the GRUB bootloader. With a SLES installation, the file containing the GRUB menu configuration options is called `menu.lst` and resides within this GRUB Root Partition. An example of `menu.lst` is shown in [Figure 6.1](#).

Figure 6.1. A sample SLES9 `menu.lst` configuration file.

[\[View full size image\]](#)



The `menu.lst` file contains a listing of possible boot configurations for the computer. These configurations typically include at least a normal bootup configuration and a failsafe configuration. All possible bootup configurations are listed in `menu.lst` and identified using the title directive. Each of these configuration entries includes a reference to the kernel being used and any number of possible kernel parameters, which are used during the initialization process. These kernel parameters are required for proper hardware initialization and can be customized to meet specific requirements of the SLES server. [Table 6.1](#) shows common kernel parameters.

Table 6.1. Common Kernel Parameters

PARAMETER	DESCRIPTION
<code>acpi=off</code>	When this parameter is set to off, the Advanced Configuration and Power Interface (ACPI) system is completely disabled.
<code>seni=oldboot</code>	

Interacting with Processes

All running processes within Linux are assigned a Process ID (PID). This PID can be used to manage and interact with each process. To locate the PID of a running process, you can use the `ps` command, as shown in [Figure 6.5](#).

Figure 6.5. The output of the `ps` command.



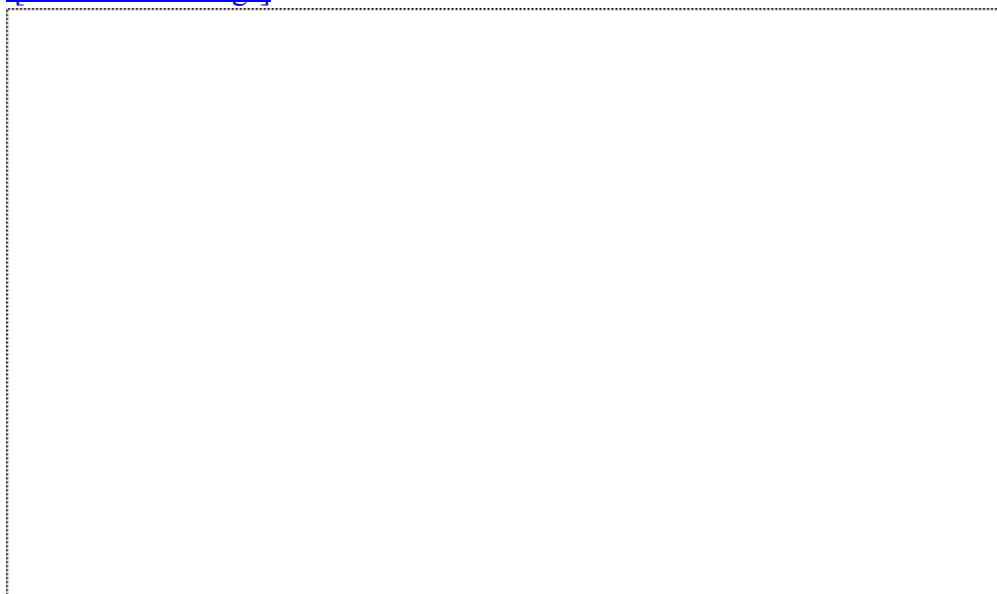
By default, the `ps` command produces a listing of all running processes in the current shell session. Using command-line switches, processes running in other sessions and background daemons can also be viewed. The information displayed for each process includes such things as the user who initiated the process, the Process ID (PID), and the Parent Process ID (PPID).

The first process started on a Linux server is the `init` process. All other processes are either spawned by `init` or spawned by a process already started by `init`. This produces a hierarchical structure for running process. Using the PPID and the PID, the path back to the `init` daemon can be tracked and is often useful when tracking down rogue or problematic processes.

Another command useful for tracking down troublesome processes is `top`, shown in [Figure 6.6](#). The `top` utility can be used to view running processes and also has the advantage of viewing processes based on statistics such as CPU utilization, memory usage, or many other parameters.

Figure 6.6. The output of the `top` command.

[\[View full size image\]](#)



Introduction to Linux Kernel Management

At the heart of the SLES operating system is the Linux kernel. As mentioned in the "[SLES Startup Procedures](#)" section of this chapter, the Linux kernel is found in the /boot directory and is typically named vmlinuz-<kernel version>. The default kernel with an OES Linux installation is version 2.6.5-7.112-default. The kernel version number can actually be divided into the following three important numbers:

- Major Number This number represents the current major version number of the Linux kernel. The Linux kernel is currently at a major number of 2.
- Minor Number This number represents the minor version number of the Linux kernel. Modern distributions are based on either minor number 4 or 6 of the Linux kernel. SLES9 uses a kernel with a minor number of 6. This kernel is commonly referred to as the 2.6 kernel.

The minor number can also be used to represent the status of the kernel version. If the minor number is an odd number (such as in kernel version 2.5), that version of the kernel is a non-stable or developmental release of the kernel. Minor numbers using an even number (such as 2.6) are known as production or stable versions of the kernel.
- Revision Number The final number of the Linux kernel version is the revision number of the kernel. SUSE also adds some information to this field to indicate the build of the kernel, as well as the specific environment the kernel was intended for. In the OES kernel version number 2.6.5-7.112-default, the revision number is 5-7 and the SUSE build number and environment designations are 112-default.

NOTE

The uname -r command can be used to display the version of the currently running kernel.

The most common administrative task relating to the kernel is most likely applying kernel updates to resolve security issues. Applying kernel updates through the YaST Online Update or Red-Carpet tools is a very straightforward process, but if problems are encountered, you may need to know more details regarding the layout of the kernel-related files.

[Table 6.5](#) outlines the important kernel-related files found within the /boot directory.

Table 6.5. Important Kernel-Related Files in /boot

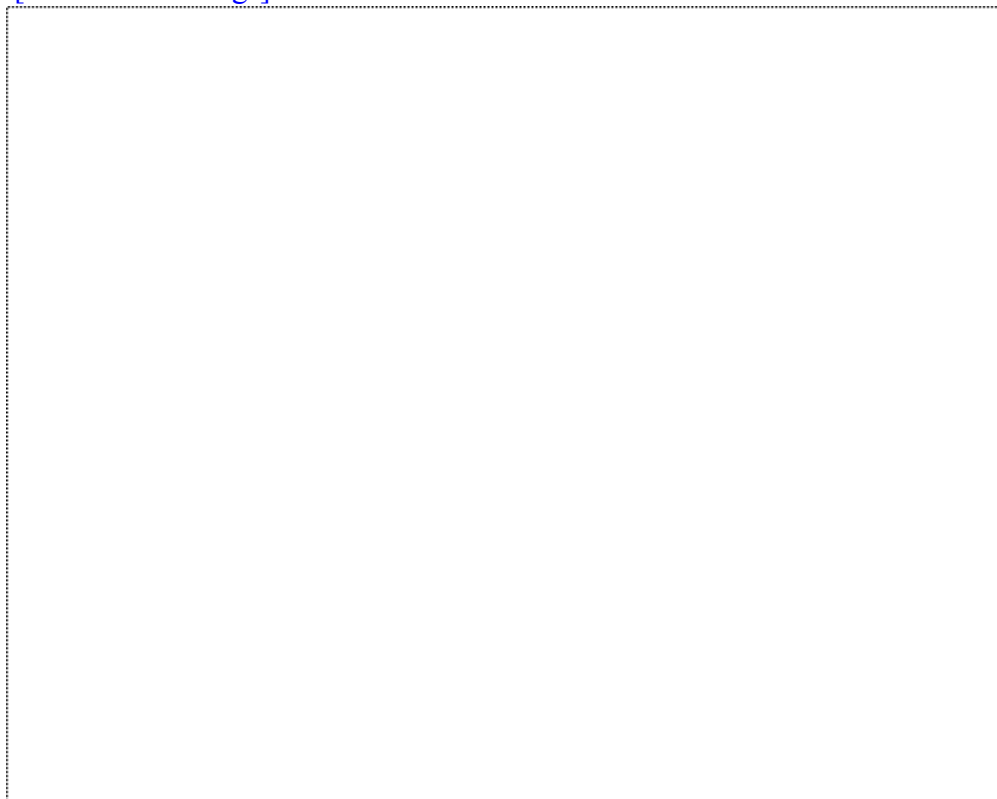
FILE	DESCRIPTION
vmlinuz-2.6.5-7.112-default	The 2.6.5-7.112-default version of the Linux kernel.
vmlinuz	A symbolic link that points to the current version of the Linux kernel. The /boot/grub/menu.lst file typically configures GRUB to reference this vmlinuz file rather than the actual vmlinuz-<version number> file.
initrd-2.6.5-7.112-default	Initialization RAM Disk used by the startup routine to provide required hardware drivers to the initialized kernel. This is used prior to the root filesystem being mounted.

Managing SLES with YaST

The Yet another Setup Tool (YaST) utility is the central management console of a SLES installation. YaST is available in a graphical version (yast2), shown in [Figure 6.7](#), and a command-line version (yast). Each of these utilities relies on the same modular system for managing installed components of SLES. Although the look and feel of these modules may change between the graphical and console-based utilities, the functionality of these modules is identical across either version.

Figure 6.7. The Yet another Setup Tool (YaST) utility.

[\[View full size image\]](#)



YaST management modules are divided into seven categories: Software, Hardware, System, Network Devices, Network Services, Security and Users, and Miscellaneous. Modules found within each category can be selected from within the YaST utility itself or initiated directly from the command line. To specifically execute a particular module upon starting YaST, the following command line should be used:

```
yast <module name>
```

TIP

To retrieve a list of all available YaST modules, use `yast l`.

Modules used for initial configuration of many of the Novell OES components are also found in YaST. These components are all represented in the graphical environment with an icon containing a red "N" for Novell. Although many of these modules are found in the Network Services category, the actual category where each module is found depends on the module in question.

WARNING

The functionality of the OES modules is mainly the installation and basic setup of each service. Most services require

Updating OES Linux

YaST provides several modules for installing and updating software on a normal SLES server. However, after installing OES, only the Red-Carpet software management system should be used. This is true when installing updates to both OES components and the core operating system.

NOTE

To prevent SLES updates, which may not be aware of OES components, the normal YaST Online Update (YOU) utility is disabled during the OES installation. It is still possible to manually execute the terminal-based YOU. This can potentially cause server corruption and should be avoided.

The Red-Carpet software management system is made up of the following two basic components:

- Red-Carpet daemon (rcd) This daemon receives commands from the Red-Carpet client and follows those instructions to perform tasks such as updating installed software components. If necessary, the startup script `/etc/init.d/rcd` can be used to stop or restart the rcd daemon.

- Red-Carpet client The client portion of Red-Carpet is the interface administrators use to subscribe to software update services, and to determine which updates will be applied to the local server.

Two Red-Carpet clients ship with OES:

- rug Terminal-based client, which is installed by default with OES.
- red-carpet Graphical client, which is an optional component during an OES installation.

WARNING

In the shipping version of OES, the graphical red-carpet utility was not working as expected. Novell recommends that you use the command-line rug utility to update OES until the fix for red-carpet is made available. When the patch is available, the rug utility will apply it and the red-carpet graphical client can then be used safely.

For the Red-Carpet process to work, a ZENworks Linux Management (ZLM) server must be added as a known service to the rcd configuration. After a successful installation of OES, your server should already have a known service for the Novell Update Server (<https://update.novell.com/data>). This can be confirmed using the command-line rug utility as in the following example:

```
# rug service-list
```

This command should display an entry for the Novell Update Service. If no entries are displayed, the Novell Update Service can be manually added to your Red-Carpet configuration using the following command:

```
# rug service-add https://update.novell.com/data
```

The graphical red-carpet utility can also be used to check for, and, if necessary, add the Novell Update Service. These options are found under the Edit, Services menu item of the red-carpet utility.

Before using Red-Carpet, your OES server must be activated. Activating an OES server requires an activation code

Monitoring SLES with Health Monitoring Services

An important aspect of managing SLES is simply being aware of how your server is performing. OES Linux reduces the complexity of this task through leveraging the capabilities of Web-Based Enterprise Management (WBEM). WBEM is a standard, Internet-based technology designed to consolidate the various tasks of enterprise server management. Through WBEM, Health Monitoring Services (HMS) can be used to easily monitor many important server health-related factors including CPU utilization, system memory, running processes, and network utilization.

OES Linux uses the Common Information Model Object Manager (CIMOM) daemon, from the OpenWBEM project, to manage the health monitoring environment. The CIMOM daemon performs this function by accessing one or more Providers that conform to WBEM standards. These Providers facilitate the gathering of SLES and OES statistics used by HMS. For administrative use, this information is then gathered and consolidated for display in iManagers so you can easily keep tabs on your server health while performing day-to-day administrative routines.

One of the great things about HMS is its potential for future capabilities. This is the first release of HMS and is geared primarily at monitoring essential health-related information. In future releases, system alerts and robust analysis should further enhance the capabilities of HMS and make this one of the most important server monitoring tools in your arsenal.

Installing HMS

Health Monitoring Services can be installed as an optional component during the OES Linux installation. HMS can also be installed later through YaST.

NOTE

Basic server health is available for any server throughout your organization, but for complete health monitoring, Health Monitoring Services must be installed on all your OES Linux servers.

To install Health Monitoring Services using YaST, complete the following steps:

1. Access YaST from a terminal using `yast`, or from a graphical environment using `yast2` or the YaST launcher from the application menu.
2. Select the Network Services category in YaST. From within this category, locate and select the Novell Health Monitoring module. This module will detect that the RPMs for HMS are missing and ask if you want to install them. Select Continue to install the necessary packages.
3. At the conclusion of the software installation, SuSEconfig is executed to update the system configuration. When this completes, the configuration of the OES component will begin automatically.
4. At the Novell Health Monitoring LDAP Server Configuration screen, enter the following information and click Next to complete the installation:
 - Local or Remote Directory Server Select the radio button that indicates whether eDirectory is running on the local server or a remote server.
 - Directory Server Address If a remote eDirectory server is in use, enter the IP address for this server.
 - Admin Name with Context Enter the eDirectory administrator's credentials using fully qualified dot notation, for example, `cn=admin.o=novell`.
 - Admin Password Enter the password for the administrator user.
 - Port Details If necessary, select this button to change the configured ports for the eDirectory server you

Troubleshooting

Troubleshooting SLES can be a complex process. The following section contains important log files, procedures, and tools used during the troubleshooting process.

System Log Files

SLES uses the System Logger (syslog) utility to track events from all running processes. These events are written to log files that can be used for troubleshooting and system analysis. When you're troubleshooting nearly any type of problem on SLES, these log files are the best place to begin. [Table 6.7](#) identifies key log files found on SLES.

Table 6.7. Important Log Files Found on SLES

LOG FILE	PURPOSE
<code>/var/log/messages</code>	The majority of syslog messages are stored in this file.
<code>/var/log/boot.msg</code>	All boot-related messages are written to this file upon system startup.
<code>/var/log/YaST2</code>	This directory contains log files for the operation of YaST and YaST modules.
<code>/var/log/cups</code>	CUPS-related log files can be found in this directory.
<code>/var/log/mail</code>	Log file for mail-related messages.
<code>/var/log/XFree86.0.log</code>	Log file containing messages relating to the XFree86 server.
<code>yast2 view _anymsg -or- yast view _anymsg</code>	Command used to launch YaST into the system log monitoring module. (yast2 is the graphical utility, and yast is the command-line version.)

NOTE

Log files for OES components can normally be located in `/var/opt/novell/log`.

/proc and /sys Filesystems

When you're troubleshooting hardware-related problems, it is often important to determine exactly what view the kernel has of all hardware devices attached to the server. The `/proc` filesystem is a virtual filesystem that allows an insight into the running kernel. Many kernel configuration values can be analyzed by viewing the appropriate file within the `/proc` directory structure.

Beginning with the 2.6 kernel, the `sysfs` filesystem has been added for accessing additional information regarding kernel data structures and attributes. This filesystem is mounted at the `/sys` directory and can be used to query specific settings of hardware devices recognized by the current kernel. As not all devices have interfaces within the `sysfs` filesystem, both the `/proc` and `/sys` filesystems must be used for low-level device management.

Chapter 7. Novell eDirectory Management

[Instant Access](#)

[What Is eDirectory?](#)

[eDirectory Architecture](#)

[eDirectory Tree Design](#)

[Managing eDirectory](#)

[Using LDAP with eDirectory](#)

[DNS and DHCP Services](#)

Instant Access

Managing eDirectory Objects

-

To create and manage eDirectory objects, you should use iManager. If available through an existing infrastructure or specifically downloaded, ConsoleOne can also be used for some tasks.

Managing Replicas and Partitions

-

To manage replicas and partitions, use iManager.

-

To manage the eDirectory schema, use iManager.

Using Indexes

-

eDirectory manages most popular indexes automatically, with no intervention on your part.

-

You can view the list of default indexes using the Index Management module (under eDirectory Maintenance) of iManager. You can also create custom indexes from this module.

Merging eDirectory Trees

-

Use iManager to merge eDirectory trees by selecting the Merge Tree option under eDirectory Maintenance. You can also use the terminal-based ndsmerge utility.

Using Additional Services with eDirectory

-

LDAP services for eDirectory provide robust eDirectory access to LDAP clients. Using ConsoleOne or iManager, configure LDAP through the LDAP Server and LDAP Group objects in eDirectory.

Troubleshooting

-

To monitor eDirectory messages, use Trace from iMonitor or the ndstrace utilities from a shell console.

-

Use iMonitor to repair an eDirectory tree (click the Repair icon in the header frame). You can also use the eDirectory option in iManager. Some repair operations will also require the use of the terminal-based ndsrepair utility.

What Is eDirectory?

In order to understand Novell eDirectory, you must first invert the standard view of network architecture. Many people assume that because the directory requires a Network Operating System (NOS) on which to run that it is part of the NOS. In reality, it is just the opposite. The directory defines the "world" of your network. As such, network servers are part of the directory, not vice versa. This is a critical shift in thinking if you are going to work effectively with directories in today's complex computing environments.

In the simplest of terms, eDirectory is a distributed and replicated database of network information that provides your network with four key services:

- - Discovery eDirectory makes it possible to browse, search, and retrieve information about the network. You can search for objects such as users, printers, and applications, or for specific properties of objects such as names, phone numbers, and configurations.
- - Security eDirectory provides a central point for authentication and access control across your entire network. You can grant specific rights to users or groups of users, control the flow of data across the network, and protect sensitive or personal information through the use of cryptographic technologies. Most importantly, eDirectory provides the foundation for managing security across networks, so you can safely and efficiently communicate with partners, suppliers, and customers without having to create a separate infrastructure to do so.
- - Storage eDirectory is at its heart a database. As such, it includes the capabilities to safely and securely store network data and protect it from corruption. It also provides a way to classify different data types, so you can manage the type of data in eDirectory and determine how it can be used. Finally, eDirectory allows you to split the database into discrete pieces and distribute those pieces across multiple servers to provide fault tolerance and improved performance for network users.
- - Relationship eDirectory allows you to model relationships between objects on the network. This allows you to move configuration information away from specific devices and make it global. Practically, this means that users can receive their profiles, privileges, and services regardless of location, connection device, or network access point. This is the foundation for providing a relatively new set of services known as Secure Identity Management (SIM), none of which is possible without a robust directory at its core.

Novell released its first version of eDirectory, then known as NetWare Directory Services (NDS), in 1993 with NetWare 4. It has been in constant improvement since that time, making it the most advanced and widely used directory in the world. The name was changed to Novell Directory Services with the release of NetWare 5 in 1998. In 2000, Novell's directory was rechristened Novell eDirectory, and was modularized so that it can be installed on platforms other than NetWare including Linux, Windows 2000/XP, and various flavors of Unix. The following sections provide you with an overview of eDirectory architecture, design considerations, and common administrative tasks and the tools for doing them.

eDirectory Architecture

The eDirectory architecture has three main aspects:

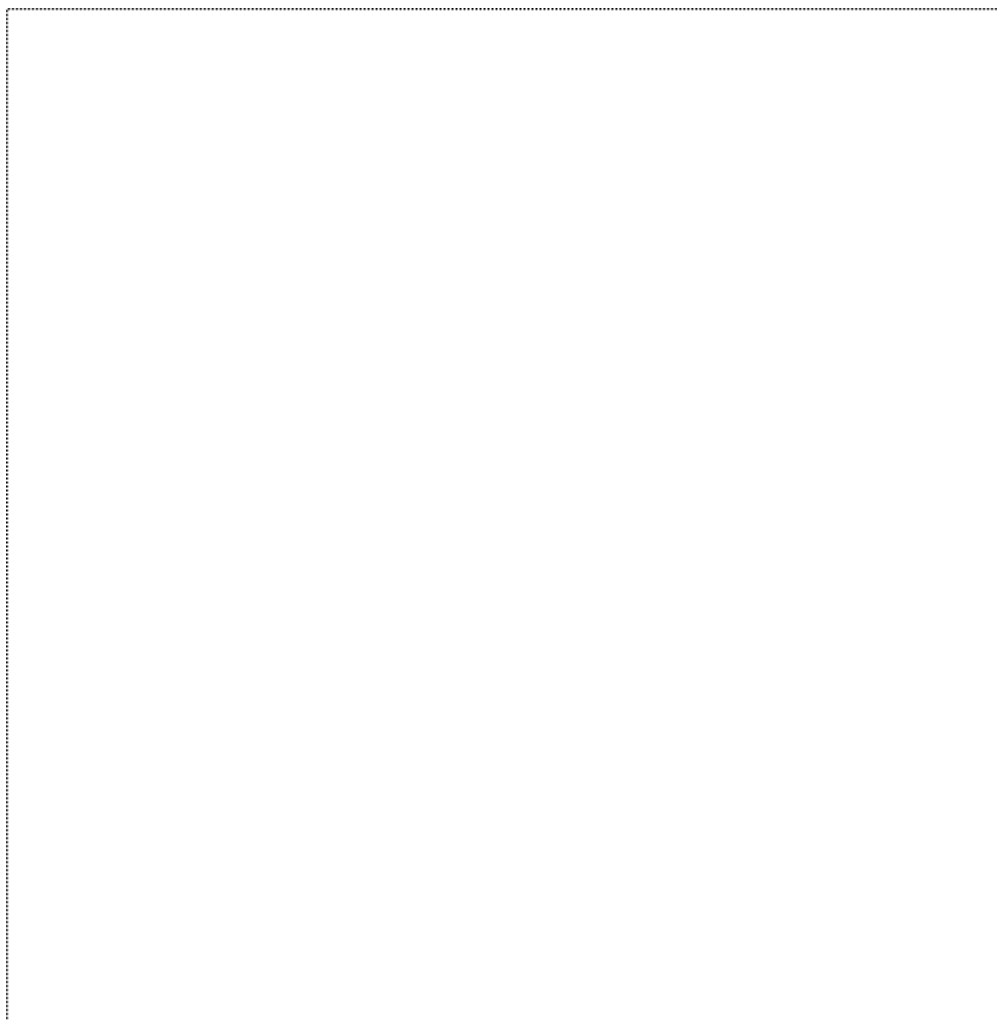
- Physical database
- Rules governing data
- Organization of data

Each of these is addressed individually in the sections that follow.

Physical Database

At its lowest physical level, eDirectory is a database. A typical database consists of a dataset together with methods of searching and retrieving specific data from the dataset. eDirectory is an object-oriented, hierarchical database. A hierarchical database maintains data (objects) in a logical tree structure. Specific objects are located by traversing (walking) the tree. Each object in the eDirectory database is uniquely identifiable by a combination of the object name, or Common Name (CN), together with information describing the location of that object within the tree, or Context. [Figure 7.1](#) shows a possible tree structure and the relationship between object name and logical position within the directory. The combination of Common Name and Context is known as the Distinguished Name.

Figure 7.1. A sample eDirectory tree structure showing how location determines name.



eDirectory Tree Design

A key purpose of implementing a network directory is to make the operation of the network more efficient and easy to use. Unfortunately, this means that the directory cannot be rolled out without any consideration for the environment into which it is being installed. There are a few basic rules that should be followed when designing an eDirectory tree:

- - The top of the tree reflects the physical layout.
- - The bottom of the tree reflects the organizational structure.
- - Organize objects to facilitate access and administration.
- - Partition and replicate for scalability and fault tolerance.

Each of these issues is addressed in the sections that follow.

Top of the Tree Reflects Physical Layout

The top one or two levels of an eDirectory tree form the foundation for everything that comes later. If these levels are not configured properly, the whole tree suffers. Similar to the construction of a house, the eDirectory tree foundation needs to be stable and not prone to changes in structure.

The stable part of an organization tends to be its capital assets (buildings and equipment). Organizational structure might change and merge, but it still generally uses the same physical facilities. Make use of this stability by designing the foundation of the eDirectory tree around physical locations.

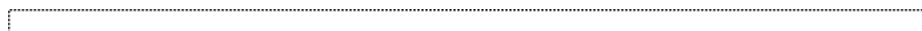
There are four main points to address when designing the top levels of the eDirectory tree:

- - Name the tree [Root].
- - Determine use of Country and Locality objects.
- - Define the Organization object.
- - Define location-based Organizational Unit objects.

When you name your eDirectory tree, you are naming the [Root] object. Make the name descriptive and unique. It should also be different from other Container objects. Many use the following tree name convention: Organization Name_TREE.

Next you have to decide how to create the first level in your eDirectory tree. This involves determining whether you are going to incorporate the use of a Country \ or a Locality (L) object into your eDirectory tree design, as shown in [Figure 7.4](#).

Figure 7.4. eDirectory Country and Locality objects.



Managing eDirectory

When you have an understanding of the basics of eDirectory architecture and design, it is important to understand the activities and tools necessary to maintain eDirectory on a day-to-day basis.

As with the rest of OES Linux, eDirectory management is performed through web-based utilities. Specifically, comprehensive eDirectory management is available through iManager and iMonitor. For information on installing and configuring both iMonitor and iManager, see [Chapter 5](#), "OES Management Tools."

iManager provides comprehensive role-based management capabilities for the entire OES Linux environment. iMonitor consolidates the monitoring and data-gathering aspects of several terminal-based tools, including ndstrace and ndsrepair. It also includes the object viewing and reporting functionality of the NetWare-only utilities, DSBrowse and DSDiag. The iMonitor interface is shown in [Figure 7.8](#).

Figure 7.8. The iMonitor user interface.

[\[View full size image\]](#)



iManager provides a complete set of eDirectory management tools and functions for object, partition, and replica operations. Much of this functionality is also available from the Partition and Replica view in ConsoleOne. As mentioned in [Chapter 5](#), although ConsoleOne is not provided with OES Linux, this utility can still be used in existing infrastructures or specifically downloaded from download.novell.com. You can also use SSH for remote access to a server terminal, from which you can run several eDirectory-specific terminal-based utilities.

This section gives you an overview of common eDirectory tasks and the tools used to perform them. eDirectory management tasks can be organized into six main categories:

- - Partition operations
- - Replica operations
- - Tree operations
- - eDirectory repair
-

Using LDAP with eDirectory

Lightweight Directory Access Protocol (LDAP) services for eDirectory lets LDAP clients access information stored in eDirectory. LDAP is currently the preferred directory access protocol on the Internet. Because eDirectory lets you give different clients different levels of directory access, you can manage external, internal, and confidential information from the same directory. eDirectory also supports secure LDAP connections so that privileged users can access internal or private information securely without any special client software. All they need is a browser with LDAP support and connectivity to the LDAP server.

Installing LDAP Services

Novell LDAP Services for eDirectory are installed automatically during the OES Linux installation routine. For more information on OES Linux installation options, see [Chapter 2](#).

Two types of objects are defined in the eDirectory schema to support LDAP Services:

- - LDAP Server object Use this object to configure the LDAP environment for a single LDAP server.
- - LDAP Group object Use this object to configure LDAP client access to eDirectory.

LDAP Services for eDirectory are an integrated component of ndsd and cannot be manually loaded and unloaded.

LDAP SERVER OBJECT

The LDAP Server object stores configuration information in eDirectory about an LDAP server. The LDAP Server object is created in the same container as your server object. Each LDAP Server object configures one LDAP server.

To configure an LDAP server, complete the following steps in iManager:

1. In the Navigation frame, open the LDAP group and select LDAP Overview.
2. Select the View LDAP Servers tab, and click the LDAP Server object with which you want to work.
3. Enter the configurable parameters in the property pages, and click the Refresh button to reset the LDAP server. Click OK when you're finished.

There are six pages of configuration parameters for the LDAP Server object:

- - Information Set the general configuration of your LDAP server on this page. The following entries are available:
 - - LDAP Group Specify the name of the LDAP group to which this server should belong.
 - - Dereference Aliases When Resolving Names Check this option to force the LDAP server to resolve to the actual object whenever it encounters an alias object.
- - Connections Sets the secure connection settings for this LDAP server with the following options:
 -

DNS and DHCP Services

DNS and DHCP services in OES Linux are provided by the traditional open source Bind and ISC DHCP Server programs. These programs are not installed by default in OES Linux, and if desired must be manually installed after the main server installation, or installed during a custom installation of OES Linux. Unlike OES NetWare, these components are not integrated into eDirectory or managed through iManager.

DNS and DHCP manage the assignment and discovery of IP addresses on a network. Both of these services are managed via YaST modules, under the Network Services category. Complete configuration of both of these services can be quite complex and is beyond the scope of the book. This section will provide a brief introduction to these services, as well as basic configuration information. For complete information on these services, refer to specific documentation for each service.

Installing DNS and DHCP Services

DNS and DHCP services can be installed as an optional service during the OES Linux installation routine. It can also be installed as a post-installation task through YaST.

To install DNS/DHCP services from YaST, each component (DNS and DHCP) must be installed separately. Complete the following steps to install the DHCP server:

1. Access YaST from a terminal using `yast`, or from a graphical environment using `yast2` or the YaST launcher from the application menu.
2. Select the Network Services category in YaST. From within this category, locate and select the DHCP Server module. This module will detect that the rpm for `dhcp-server` is missing and ask if you want to install it. Select Continue to install the necessary packages.
3. At the conclusion of the software installation, `SuSEconfig` is executed to update the system configuration. When this completes, the configuration of the DNS server will begin automatically.
4. The first step of configuring the DHCP Server is determining which interface the DHCP server will run on. Select the appropriate interface and click Next.
5. At the DHCP Global Settings page, enter the following information and click Next:
 - LDAP Support To store the DHCP configuration in LDAP, select this option. This is not normally used with eDirectory.
 - Domain Name Contains the domain name used when leasing addresses to clients.
 - Primary Name Server IP Enter the IP address of the primary DNS name server. If you're using DNS, this may be the address of the local server.
 - (Optional) Secondary Name Server IP Enter the IP address of a secondary DNS name server.
 - Default Gateway (Router) Enter the IP address of the default gateway on the current LAN segment.
 - (Optional) Time Server Enter the IP address of the NTP server used for synchronizing time.
 - (Optional) Print Server Enter the IP address of the print server to be offered to clients. If you are using iPrint, this is not necessary.
 - (Optional) WINS Server Enter the IP address of a Windows Internet Naming Service (WINS) server if desired.

Chapter 8. Users and Network Security

[Instant Access](#)

[Overview of Users in OES Linux](#)

[eDirectory User-Related Objects](#)

[eDirectory Authentication](#)

[eDirectory Authorization](#)

[Provisioning Linux Users](#)

Instant Access

Creating Users and Groups

- - To create User and Group objects, use iManager.
- - To set up a template so that all users you create receive a set of common characteristics, use iManager to create a Template object.

Ensuring Login Security

- - To create account restrictions, access the user or group properties through iManager.
- - To set or change passwords, access User object properties with iManager.

Working with eDirectory Security

- - To view or change eDirectory object or property rights, use iManager.

Overview of Users in OES Linux

At its fundamental level, OES Linux provides file and print services and network-enabled application support to end users. These user-level services all require some method of locating a valid user account, and then authenticating the requested user to that account. When identity and permissions have been established, the service is started with the appropriate environment.

OES user accounts are all stored and managed within eDirectory. Not all applications and services, however, directly integrate or support eDirectory. To bring eDirectory functionality to as many applications as possible, OES Linux provides support for two primary methods of authentication:

- Native eDirectory
- LDAP

Native eDirectory

Native eDirectory-aware services are those services that understand the eDirectory Application Program Interface (API). Services that understand this API have the advantage of being able to directly communicate with eDirectory and leverage the many advanced features eDirectory has offered for years.

OES Linux offers several services that communicate directly to eDirectory through this API. Examples of this include iManager, Virtual Office, iFolder, the Novell Client, and many others. Through direct API communication with eDirectory, these services can leverage such things as advanced authentication mechanisms and complex permission structures offered on NSS volumes.

LDAP

Services that do not leverage the eDirectory API can still take advantage of eDirectory for user storage and account management. To accomplish this, services rely on an industry standard known as Lightweight Directory Access Protocol (LDAP).

LDAP is a protocol used to communicate with directories containing some form of information. In the case of eDirectory, the information being requested is quite often user account details. OES Linux installations with eDirectory automatically support LDAP connections for this purpose. LDAP-aware services can be configured to take advantage of this through the use of an LDAP connection to eDirectory. This connection is then used to locate and authenticate user accounts prior to the service being initiated.

OES Linux relies on this LDAP functionality for a number of important Linux services. One example of this is Samba. The Samba software suite provides Linux resources to Windows users as though the Linux server were actually running Windows. This functionality requires Windows users to authenticate to the Linux server just as they would with any other Windows machine. Traditionally, Samba stores users in a local file, unique to Samba. With OES Linux, Samba is configured to use LDAP to locate eDirectory users who are allowed access to Samba resources.

Another example of this situation is the integration of Pluggable Authentication Module (PAM) enabled services into eDirectory. As with Samba, eDirectory user objects are modified with OES to provide local Linux authentication to any PAM-aware service via LDAP and eDirectory. This is provided through the Linux User Management component of OES. Services that can use this functionality include such things as SSH, FTP, and local Linux logins.

It is important to understand that for these services that do not natively support eDirectory, the following three conditions must be met in order to support LDAP storage and authentication of accounts:

- eDirectory with LDAP enabled. By default, OES Linux configures eDirectory with LDAP support. This can

eDirectory User-Related Objects

OES users are all stored as objects within eDirectory. In addition to replicating these objects across servers and providing basic account authentication services, eDirectory provides a solid security model that includes such things as trustee assignments, administrative roles, inherited rights, and rights filters. Understanding user-related objects, as well as the security model provided by eDirectory, is critical to implementing a secure user environment.

There are three main eDirectory objects that are used to organize your network users. You can use iManager to create and manage each of these types of objects (for more information on iManager, see [Chapter 5](#), "OES Management Tools"):

- - User object
- - Group object
- - Organizational role

These objects form the foundation from which eDirectory-based network services and privileges are ultimately delivered. After all, user-related objects define the human elements of your network. Immediately after a new OES Linux and eDirectory installation, the only eDirectory User object that exists is Admin (the root user does exist, but is stored as a local Linux user, rather than stored within eDirectory). Although it might be comforting to think of a network of one, you are going to have to create user accounts for every one of your users. After user accounts have been created, your users can begin working on the network. In most cases, users on a network will notice very little difference from working on a standalone computer. They still use the applications they were using before. They still open, save, and delete files the same way. They can still play the same games but only if you let them!

And that's the goal of network security: to prevent users from taking some action, either unintentionally or intentionally, that might compromise the integrity of the network or expose network resources in such a way that can cause harm to the network or the organization. There are several levels of network security in today's networks, and OES Linux gives you a great deal of control over each.

The User Object

To create an eDirectory User object, complete the following steps:

1. Launch iManager. In the Navigation frame, open the Users group and select Create User (see [Figure 8.1](#)).

Figure 8.1. Creating a new user in iManager.

[\[View full size image\]](#)



eDirectory Authentication

Authentication provides the doorway for access to network resources. Without a strong authentication mechanism, sensitive network resources are essentially laid bare for anyone to access. The primary authentication method currently used with eDirectory is the username/password combination. Novell Modular Authentication Service (NMAS) makes it possible to integrate more advanced authentication and authorization techniques into your OES environment. Furthermore, NMAS offers Universal Passwords, which improve the traditional password-based authentication method.

Novell Modular Authentication Service

NMAS is designed to help you protect information on your network. NMAS offers a more robust framework for protecting your OES Linux environment. If you're not familiar with the different components of NMAS, you should get to know the following concepts. More information about each of these is provided in the OES Linux online documentation.

PHASES OF OPERATION

There are specific times when NMAS can be useful in helping to secure your network environment:

- User identification occurs prior to the actual authentication process. It provides a way to automatically gather a user's authentication information and use it to populate the Novell Login dialog in the Novell Client.
- Authentication is the opportunity for users to prove they are who they claim to be. NMAS supports multiple authentication methods.
- Device removal detection is the capability to lock down a workstation after authentication when it becomes clear that the user is no longer present.

Each of these phases of operation is completely independent. You can choose to use the same, or completely different, identification techniques for each phase. To provide this functionality, NMAS introduces a few additional concepts to eDirectory authentication:

- Login factors
- Login methods and sequences
- Graded authentication

LOGIN FACTORS

NMAS uses three approaches to logging in to the network, known as login factors. These login factors describe different items or qualities a user can use to authenticate to the network:

- Password authentication Also referred to as "something you know," password authentication is the traditional network authentication method. It is still responsible for the lion's share of network authentication that goes on, including LDAP authentication, browser-based authentication, and most other directories.
-

eDirectory Authorization

Now that users have authenticated to the network, you must provide them with access to all the resources they need. This also entails preventing them from accessing resources that they do not need. It wouldn't do to have sensitive documents describing future products open to and accessible to just anyone. The reality of the corporate world is that some resources must be maintained as "need to know."

Although determining exactly who needs access to what is a decision beyond most network administrators, Novell eDirectory provides powerful tools for implementing those decisions. This section discusses eDirectory access control concepts and how they work together to provide proper access to objects in the eDirectory tree.

Access Control Lists

Access control lists (ACLs) are stored in each eDirectory object to identify those other objects that have been granted some sort of control over it. Each object in an eDirectory tree maintains two types of access rights. The first set of rights is entry rights. Entry rights define how an object can be manipulated by other directory entities, as described in [Table 8.1](#).

Table 8.1. Valid Entry Rights in eDirectory

ENTRY RIGHT	DESCRIPTION
Browse	Allows a trustee to discover and view the object in the eDirectory tree.
Create	This right applies only to container objects. It allows the trustee to create new objects within the container.
Delete	Allows a trustee to delete the object.
Rename	Allows a trustee to rename the object.
Supervisor	Allows a trustee full access to the object and its attributes.

The second set of rights is property rights. Property rights define how the attributes associated with an object can be manipulated. eDirectory property rights are described in [Table 8.2](#).

Table 8.2. Valid Property Rights in eDirectory

PROPERTY RIGHT	DESCRIPTION
Compare	Allows a trustee to compare or to see if an attribute contains a given value.
Read	Allows a trustee to read an attribute value. This right confers the Compare right.
Write	Allows a trustee to add, delete, or modify an attribute value. This right confers the add or delete Self right to the attribute.

Provisioning Linux Users

As mentioned at the beginning of this chapter, not all services support native eDirectory authentication. This is especially apparent within the services commonly associated with Linux environments.

Typical Linux servers provide user authentication for a number of services. Common examples of these are local logins, secure shell connections, Samba, NFS, and HTTP/FTP access. Managing user accounts across these access methods can be the most frustrating part of administration! Thankfully, OES Linux greatly simplifies this aspect of administration through enabling eDirectory as a central storage location for all user accounts across all services.

The central component of OES that provides this integration is Linux User Management.

Linux User Management

In a nutshell, Linux User Management (LUM) is a directory-enabled application that centralizes the storage and management of Linux user accounts. LUM uses eDirectory for the back-end repository of users and therefore benefits from the security, scalability, and reliability eDirectory users have come to expect.

LUM extends the capabilities of the Novell Account Management (NAM) software and includes the following components:

- - NAM Pluggable Authentication Module (pam_nam) This module provides eDirectory authentication through LDAP for all PAM-aware services. When authenticated, users have the same privileges as when authenticating through NIS, NIS+, or local files.
 - Linux Administrators may equate this to the pam_ldap module. Although the primary purpose of pam_nam is to provide LDAP authentication, similar to pam_ldap, pam_nam offers a closer integration with eDirectory with the following additional benefits:
 - Unique UIDs and GIDs across the LDAP tree, or LUM domain
 - Advanced server access control based on LDAP access control lists (ACLs) in eDirectory
 - Refined LDAP searches offering a more effective integration with eDirectory
- - NAM Name Service Switch (libnss_nam) redirector This redirector enables user lookup through an LDAP connection to eDirectory. This is used to enforce permissions when accessing system resources.
- - NAM Cache Daemon (namcd) This daemon caches all user lookups performed by NAM. This cache is checked first when performing user lookups. If the requested resource is located with the cache, the LDAP lookup against eDirectory will not be performed. This greatly increases name resolution performance.
- - Command-Line Utilities Many different command-line utilities exist to add Linux administrators. These utilities can be used in place of iManager for basic LUM administration. More information on these utilities will be available later in this section.

LUM-RELATED OBJECTS

In addition to the physical components of LUM, in order for LUM to integrate Linux authentication into eDirectory

Chapter 9. OES Clustering Services

[Instant Access](#)

[Clustering Benefits](#)

[Clustering Fundamentals](#)

[Clustering Terminology](#)

[Installing Novell Cluster Services](#)

[Configuring Novell Cluster Services](#)

[Always-Available File Access](#)

[Always-Available Network Services](#)

[Understanding Resource States](#)

Instant Access

Installing Novell Cluster Services

- You can install Novell Cluster Services (NCS) from YaST. OES Linux ships with a license for a two-node cluster. Clusters of a larger size require additional licenses, which are purchased separately.
- If you are upgrading an existing NetWare cluster environment to OES Linux, perform a rolling conversion by upgrading one node at a time.

Configuring Clusters

- Configure your cluster environment from the Cluster Options page in iMonitor.
- Cluster-enable a storage pool by selecting New Cluster Pool from the Cluster Options page in iManager.
- Cluster-enable an application or service by creating a new cluster resource from the Cluster Options page in iManager.
- Configure parameters for individual cluster resources in iManager by accessing the resource properties from the Cluster Options page.

Monitoring Clusters

- Monitor your cluster environment from the Cluster Management page in iManager.
- View the status of the cluster and the various cluster resources from the Cluster Management page in iManager.

In order to remain competitive, your organization needs to provide customers and employees uninterrupted access to data, applications, websites, and other services 24 hours a day, 7 days a week, 365 days a year.

This makes high availability of your organization's services more than a technical issue. It's a business issue that requires a reliable solution.

Novell Clustering Services (NCS) is a multinode clustering system for OES Linux that is integrated with Novell eDirectory. NCS ensures high availability and manageability of critical network resources including data (server volumes), applications, and OES Linux services. NCS supports failover, failback, and migration (load balancing) of individually managed cluster resources.

NOTE

A license for a two-node NCS cluster is included with OES Linux. Licenses for additional cluster nodes must be purchased separately from Novell.

Clustering Benefits

NCS allows you to configure up to 32 OES Linux servers into a high-availability cluster, where resources can be dynamically switched or moved to any server in the cluster. Resources can be configured to automatically switch or move to another node in the event of a server failure. They can also be moved manually, if necessary, to troubleshoot hardware or balance server workload.

One of the best things about NCS is that it enables you to create a high-availability environment from off-the-shelf components. You don't have to spend millions when you create a cluster, and you can add servers to the cluster as your needs change and grow over time.

Equally important is the capability to greatly reduce unplanned service outages that result from server failures of some sort. You can even reduce the frequency of planned outages for software and hardware maintenance and upgrades because individual nodes can be removed from the cluster without affecting service availability to network users.

NCS provides the following advantages over a nonclustered environment:

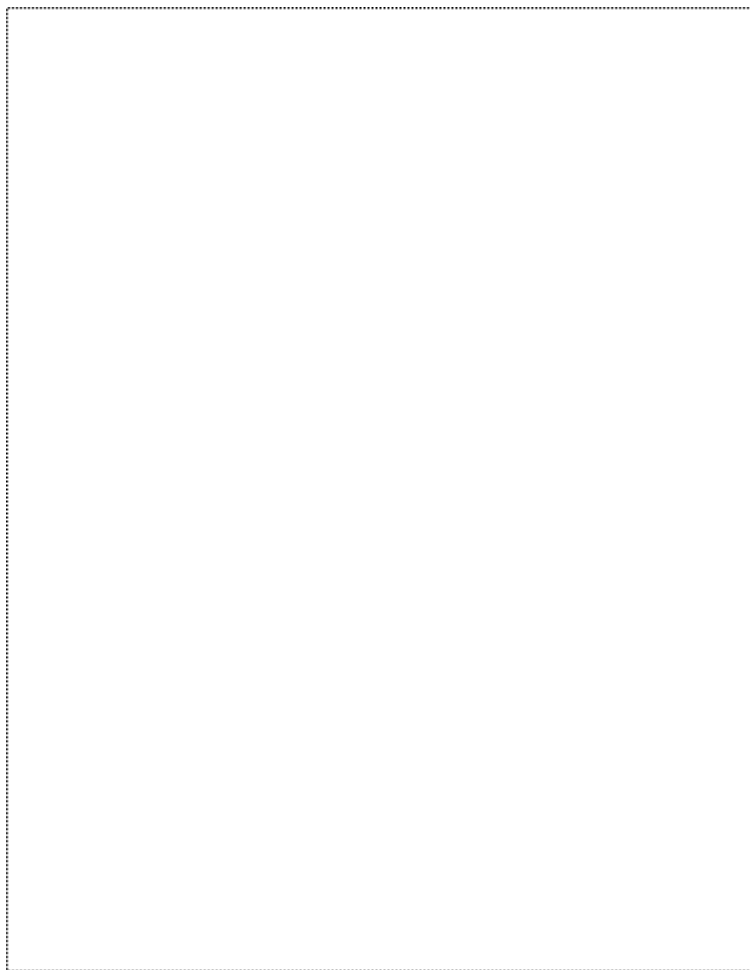
- Increased availability
- Improved performance
- Low cost of operation
- Scalability
- Disaster recovery
- Data protection
- Shared resources

Because of these advantages, clustering systems are becoming mandatory for environments in which system availability is a must.

Clustering Fundamentals

Suppose you have configured a two-node cluster, with a web server installed on each of the nodes. Each of the servers in the cluster hosts two websites. All the content for all four websites is stored on a shared disk subsystem connected to each of the servers in the cluster. [Figure 9.1](#) shows how such an environment might look.

Figure 9.1. The basic cluster architecture.



During normal operation, each clustered node is in constant communication with the other nodes in the cluster through periodic polling. In this way, a node can quickly detect whether something happens to another node in the cluster.

If node 2 fails due to some hardware or software problems, users currently attached to the web server will lose their connections. The IP address associated with node 2 and all its services are migrated to node 1. Users would likely have to reload their web pages, which would be available from the new node within a few seconds.

After the problem in node 2 is located and repaired, it is restarted and automatically re-inserts itself into the cluster. Node 1 detects the return of node 2 and seamlessly passes back all the addresses and services originally assigned to node 2. The cluster returns to its normal configuration without any administrator intervention.

Clustering Terminology

We all know that clustering provides a high-availability platform for your network infrastructure. High availability is becoming increasingly important for two purposes: file access and network services. The following sections discuss NCS configuration for both of these situations. However, before you start working with an NCS cluster, you should be familiar with the terms described in the following sections.

Master Node

The first server that comes up in an NCS cluster is assigned the cluster IP address and becomes the master node. (Other nodes in the cluster are often referred to as slave nodes.) The master node updates information transmitted between the cluster and eDirectory, and monitors the health of the cluster nodes. If the master node fails, NCS migrates the cluster IP address to another server in the cluster, and that server becomes the master node.

Cluster-Enabled Volume

A cluster-enabled volume is an NSS volume configured to provide location-transparent access to OES Linux file services. The volume is associated with an eDirectory virtual server object that provides a unique secondary IP address for locating the volume on the cluster's shared storage device. The volume provides read-write file access to users.

NOTE

OES Linux clusters failover storage pools. This means you can migrate more than one volume at a time to another node if they are part of the same storage pool. For more information on Novell Storage Services (NSS), see [Chapter 11](#), "OES Linux File Storage and Management."

Cluster Resource

A cluster resource is an object in eDirectory that represents an application or other type of service (such as DHCP or the master IP address) that you can migrate or fail over from one node to another in an NCS cluster. The cluster resource object includes scripts for unloading the service from one node and loading it on another node. In most cases, make sure the service is installed on all nodes in the cluster that will host the service.

Heartbeats and the Split-Brain Detector

NCS uses heartbeats on the LAN and a Split-Brain Detector (SBD) on the shared storage device to keep all services highly available on the cluster when a node fails. NCS determines when a node fails over the LAN and casts off the failed node through the following process:

- - Every second (by default), each node in an NCS cluster sends out a heartbeat message over the network.
- - The master node monitors the heartbeats of all other nodes in the cluster to determine whether they are still functioning.
- - If a heartbeat is not received from a node during a predefined timeout (eight seconds by default), that node is removed (cast off) from the cluster, and migration of services begins.

NOTE

If the master node fails to send a heartbeat within the predefined timeout, it is cast off, and another node takes over

Installing Novell Cluster Services

The following list specifies the minimum hardware requirements for installing NCS:

- - A minimum of two OES servers.
- - At least 512MB of memory on all servers in the cluster. This provides sufficient memory to support failover of multiple applications to the same server node.
- - At least one local disk device on which the root filesystem will be installed for each node.
- - A shared disk system, either Storage Area Network (SAN) or iSCSI, is required for each cluster in order for all cluster data to be available to each node. This is how high availability of data is achieved.

NOTE

NCS will create a special cluster partition using one cylinder of one drive of the shared disk system. This will require roughly 20MB of free disk space on the shared disk system for creating the cluster partition.

WARNING

Be aware that it is possible to access shared disk systems by servers both in and out of the cluster. With NCS, this can cause corruption and possibly loss of the entire volume. To avoid this problem, ensure that only servers within the cluster access the shared disk system. If a noncluster server must access the same disk system, ensure that access is only granted to noncluster volumes.

- - Make sure the disk system is installed and configured in accordance with the manufacturer's instructions.
- - Make sure that the disks in the shared disk system are configured in some type of fault-tolerant configuration, such as mirroring or RAID 5. If this is not done, a single disk error can potentially cause a volume failure across the entire cluster.

Configuring the Shared Disk System

Prior to installing NCS, access to the shared disk system should be configured. One of the easiest methods of accessing a shared disk is through iSCSI. iSCSI is a new standard that makes it possible to transmit SCSI communications over a network by encapsulating them in standard TCP/IP data packets. This enables you to create a low-cost Storage Area Network (SAN) using regular high-speed network hardware, and avoid the considerable costs previously associated with fiber-based SAN architectures.

ISCSI BASICS

Two main components are required for iSCSI access to a shared disk:

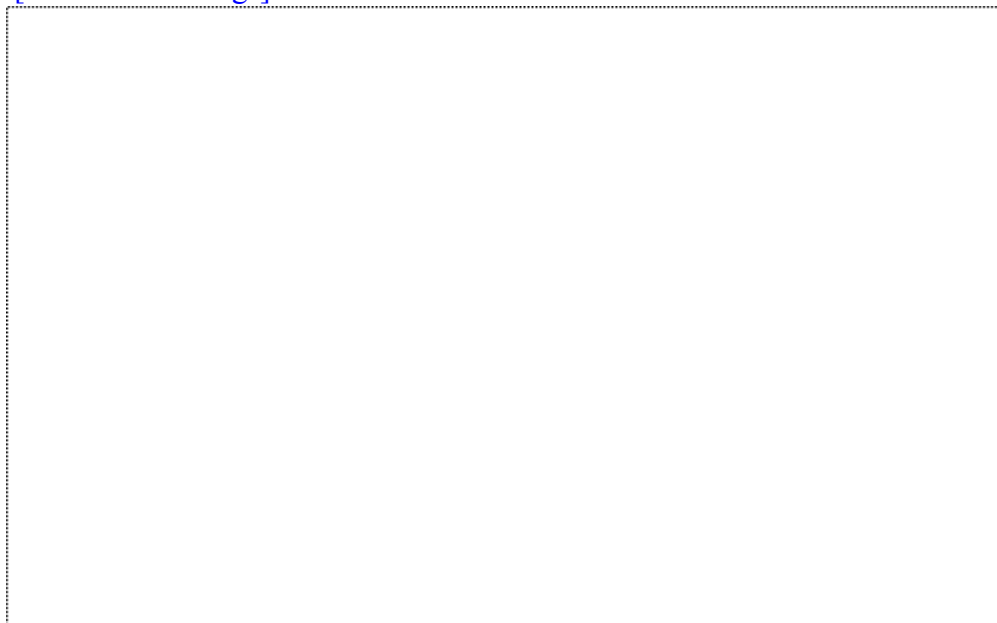
- - iSCSI Initiator software is installed on each server that will use the shared iSCSI storage. The initiator software allows an OES Linux server or cluster to communicate with an iSCSI storage server or other iSCSI target over a normal TCP/IP network.

Configuring Novell Cluster Services

There are some general configuration options for your NCS environment of which you should be aware. All of these configuration options are available from the Cluster Options page in iManager, shown in [Figure 9.3](#).

Figure 9.3. Cluster Options page in iManager.

[\[View full size image\]](#)



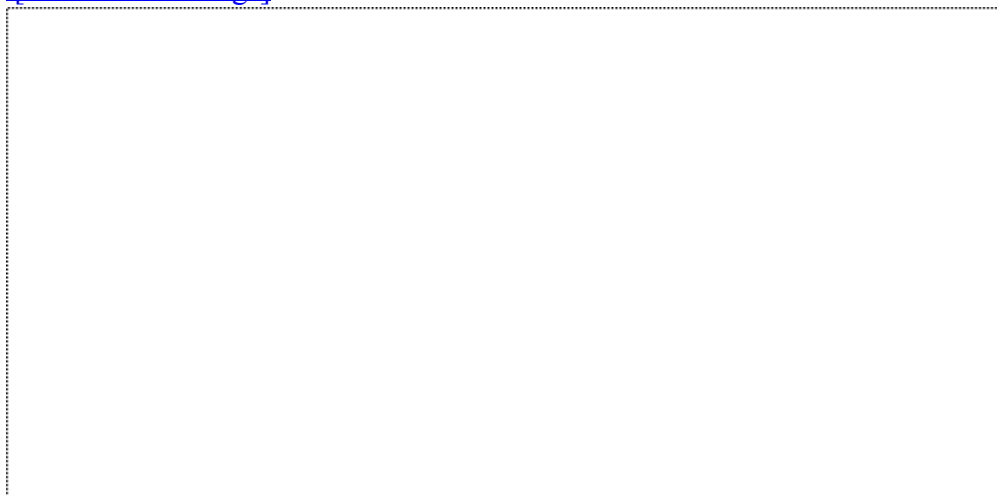
To access the Cluster Options page in iManager, perform the following steps:

1. From within iManager, select the Cluster Options link, found under the Clusters category.
2. In the right pane, use the Object Selector or Object Browser tools to locate your cluster object. After you select the cluster object, the current page will automatically reload.

From this page, configuration parameters used to configure the entire cluster environment can be accessed. To view these options, select the Properties button from the Cluster Options page. This will open the Cluster Properties page, shown in [Figure 9.4](#). The various configuration settings available from this page are described next.

Figure 9.4. Cluster Properties page in iManager.

[\[View full size image\]](#)



Always-Available File Access

To make network data constantly available through your newly created cluster, you need to create and configure shared cluster pools and volumes. Shared volumes can be any of the traditional Linux filesystems (Reiser, EXT2/3, and so on) or NSS. Shared NSS volumes must be created on shared NSS pools. NSS pools can be designated as sharable either during or after creation. This is possible through both iManager and the command-line nssmu utility. To create a cluster-enabled NSS pool during pool creation via iManager, complete the following steps:

1. From within iManager, select the Pools link, found under the Storage category in the left navigation frame.
2. In the right pane, use the Object Selector or Object Browser tools to locate your cluster object. After you select the cluster object, the current page will automatically reload.
3. Select New to create a new pool.
4. Enter the name of the NSS pool, and click Next.

NOTE

Because periods are used as delimiters in fully qualified names in eDirectory, periods cannot be used in the naming of your NSS pool. If spaces are used in the name, eDirectory will convert those spaces to underscores.

5. Check the box next to the device on which the NSS pool should be created. Also enter the size of the new NSS pool. If desired, select the Mount on Creation check box to make the pool available after creation.
6. Select Finish to create the new NSS pool. For more information on NSS pools, see [Chapter 11](#).
7. You can either select to cluster-enable the pool now or later. You must cluster-enable a pool in order for it to fail over during a failure. If you choose to cluster-enable the storage pool now, you have to provide the following information:
 - Virtual Server Name Change the name of the default Virtual Server object. When you cluster-enable a pool, the Virtual Server object is named by combining the Cluster object name and the Pool object name. For example: QuillsCluster_SharePool_Server.
 - CIFS Server Name If you select CIFS as an advertisement protocol, specify a server name that CIFS clients will see for this storage when browsing the network.
 - IP Address Each cluster-enabled pool requires its own IP address. This IP address is used to provide access and failover capability to the pool. It is assigned to the storage pool and associated with volume within the pool. All volumes in the storage pool share the same IP address.
 - Advertising Protocols Specify how you want the shared storage pool to advertise its existence to clients. AFP is used by Macintosh clients, CIFS is used by Microsoft Windows, and NCP is used by the Novell client.

Cluster-Enabling a Volume After Pool Creation

When you have created the NSS pool, you can add sharable NSS volumes. Shared volumes can be created with either iManager or nssmu. The following steps can be used to create a shared volume using iManager:

1. From within iManager, select the Volumes link, found under the Storage category in the left navigation frame.
2. In the right pane, use the Object Selector or Object Browser tools to locate your cluster object. After you select the cluster object, the current page will automatically reload.

Always-Available Network Services

When you are ready to start loading applications and services in a clustered environment, there are some extra steps you have to take beyond the standard installation and configuration provided by the application or service. As with a cluster volume, you will most likely need to cluster-enable the application or service. You might also have to make some changes to the Cluster object and the cluster nodes so that they can properly support the new application or service.

Cluster Resource Applications

When creating a resource for an NCS cluster, you need to be familiar with the following types of applications:

- Cluster-aware Cluster-aware applications are specifically designed to take advantage of a clustered environment. These applications and services recognize when they are running on a cluster. They will automatically tweak their internal settings to be more tolerant of communication lapses that occur in a clustered system.
- Cluster-naive Although you can cluster-enable any application, if it is not designed to recognize that it is running on a cluster, the application is referred to as cluster-naive. For a cluster-naive application or service, NCS does all the work to ensure that the resource is reloaded on another node if the assigned cluster node fails.

Many OES Linux services, and some third-party applications as well, are designed to take advantage of Novell Clustering Services when it is detected. For example:

- Apache Web Server and Tomcat Servlet Engine
- GroupWise (MTA, POA, GWIA, WebAccess)
- iFolder
- iManager
- iPrint
- Novell clients (Windows 98 and Windows XP/2000)
- NetStorage

As you can see from this list, you can leverage the advantages of clustering with many types of applications, thereby making your entire network more resilient to failures.

Cluster-Enabling an Application

You cluster-enable a service or application by creating a Cluster Resource object for it in eDirectory.

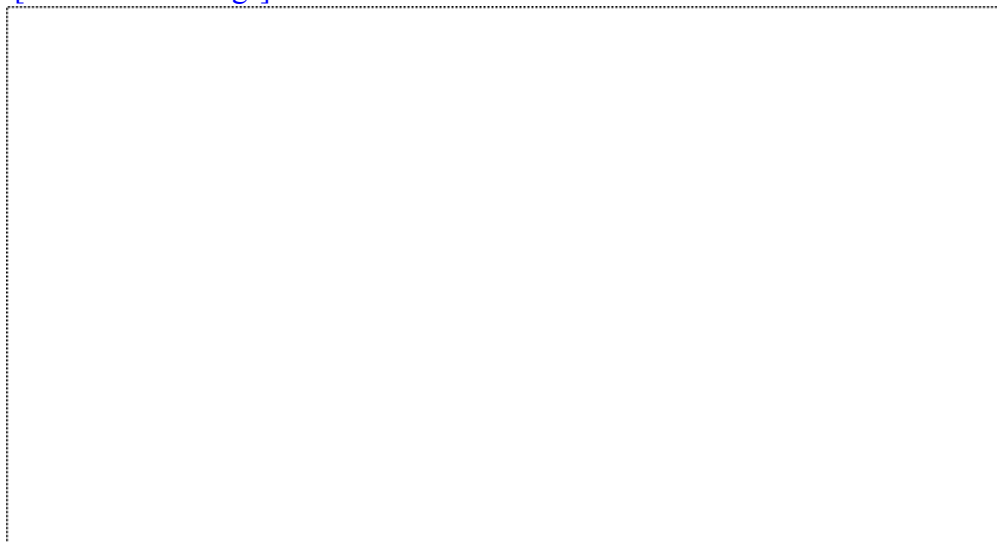
To create a cluster resource for an application, complete the following steps:

Understanding Resource States

When running or testing an NCS cluster, you can view valuable information about the current state of your cluster, and its various resources, from the Cluster Management view in iManager (see [Figure 9.5](#)).

Figure 9.5. View of cluster status in iManager.

[\[View full size image\]](#)



In order for the Cluster Manager to report your cluster configuration, you must locate and select your cluster object from eDirectory using the Cluster link. After you select the object, the Cluster Manager page will refresh and display information on the current cluster.

Some of the specific cluster information you can gather from the Cluster Manager view includes the following:

- - An icon represents each node in your cluster. The yellow disk indicates the node that is functioning as the master server in the cluster. The master server can change over time due to failover or migration events that take place.
- - Epoch indicates the number of times the cluster state has changed. The epoch number will increment each time a node joins or leaves the cluster.
- - The Run Report link provides a detailed report of your cluster. This report includes the cluster settings, quorum member information, and load and unload scripts.
- - In the Cluster State View window, each node of the cluster is listed along with its node type and associated resource state.

[Table 9.1](#) describes different resource states you might see in the Cluster State View window of the Cluster Manager page in iManager and provides some possible actions for each state.

Table 9.1. Cluster Resource States

RESOURCE STATE	DESCRIPTION	ACTION
----------------	-------------	--------

Chapter 10. Identity Manager Bundle Edition

[Instant Access](#)

[How Identity Manager Works](#)

[Installing the Identity Manager Engine](#)

[Installing Remote Loaders and Drivers](#)

[Installing Identity Manager on a Secondary eDirectory Tree](#)

[Configuring an Identity Manager Driver](#)

[Identity Manager Password Synchronization](#)

Instant Access

Installing Identity Manager Bundle Edition

- - Install the Identity Manager engine from the Identity Manager Bundle Edition CD-ROM using the command-line installation program.
- - Install Identity Manager drivers and management plug-ins (for iManager) from the Identity Manager Bundle Edition CD-ROM at the application server or workstation destination.

Configuring Identity Manager Bundle Edition

- - Use the Identity Manager management plug-ins to configure and manage your Identity Manager environment from iManager.

Originally released in the fall of 2001 as DirXML, Identity Manager has become an award-winning and groundbreaking tool for integrating the diverse systems in today's modern networks. OES Linux includes a fully functional version of Identity Manager suitable for linking some of today's most common directory systems into a cohesive whole.

NOTE

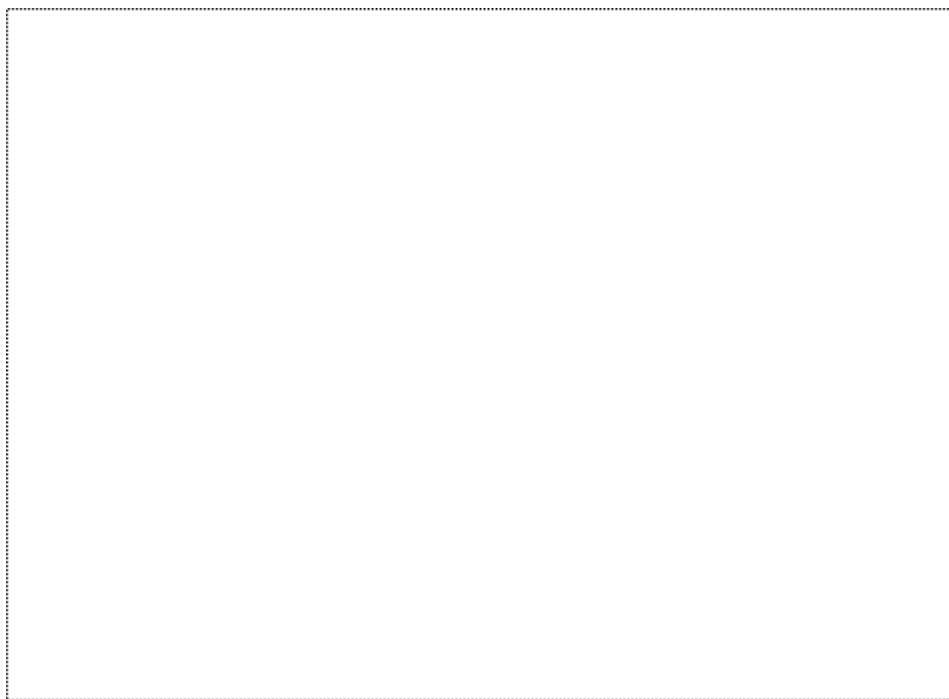
The rename of DirXML to Identity Manager was a fairly recent change. As such, a number of utilities still reference Identity Manager as DirXML. For all practical purposes, these two terms are synonymous.

Derived from Nsure Identity Manager 2, Identity Manager Bundle Edition enables you to bidirectionally synchronize data and passwords between Novell eDirectory, Microsoft Active Directory, and Microsoft Windows NT domains.

How Identity Manager Works

Identity Manager Bundle Edition allows you to link your disparate network data sources together using Novell eDirectory as the central repository for sharing data, as shown in [Figure 10.1](#).

Figure 10.1. Logical architecture of Identity ManagerHub and Spoke.



The Identity Manager architecture consists of several components that work together to achieve effective data and password synchronization:

- Identity Manager Engine Running on OES Linux, the Identity Manager engine functions as the communications hub that provides data and password synchronization between your central eDirectory tree and any participating external systems. The Identity Manager engine uses Extensible Markup Language (XML) to create object models of any data event. It then applies a set of rules to determine if, and how, the data modifications are sent to participating systems. The centralized Identity Manager engine makes sure that data events are processed consistently throughout your network environment.
- Identity Manager Drivers Customized to each system that will participate in Identity Manager synchronization, the Identity Manager drivers act as communications "spokes" or channels between your central eDirectory tree and any participating external systems. Identity Manager drivers are configured to subscribe to data changes made in the central eDirectory tree, and publish data changes that occur locally to the central eDirectory tree. This publish/subscribe model gives you complete control over the nature and direction of data synchronization.

NOTE

To simplify configuration, Identity Manager Bundle Edition provides configuration files that you can import into a driver during installation to automatically set up driver rules, filters, and transformation documents that dictate what data from this system should be exchanged with other systems and how this data should be exchanged.

Installing the Identity Manager Engine

Identity Manager Starter Pack components are installed on those servers that will participate in the data synchronization process. iManager components must also be installed on your iManager server if it is different from the server running the Identity Manager engine. To install the Identity Manager engine on your OES Linux server, complete the following steps:

1. At the OES Linux server where you want to install Identity Manager, insert the Identity Manager Bundle Edition CD-ROM.
2. Mount the CD-ROM, and then locate and execute the installation program `/linux/setup/dirxml_linux.bin`. You must execute this command as the root user.
3. Review the Welcome information and press Enter to continue.
4. At the License Agreement screen, review the agreement and enter Y to accept the usage terms.
5. Specify the appropriate number (14) for the components you want to install. The DirXML Server (option 1) must be installed on the local OES server. Remember that Identity Manager drivers and management components can be installed on separate servers from the Identity Manager engine, if you like. To install multiple components on the local server, either perform the installation multiple times, or select option 4 and customize the component installation list.
6. (Optional) Depending on the options you entered, you may be prompted for LDAP credentials or the server's SSL port.
7. Verify the summary information and press Enter to begin the package installation. If you have selected to install the DirXML server, your eDirectory server will be shut down during the installation.
8. After the installation has completed, press Enter to close the installation program.
9. (Optional) If you only installed the DirXML engine, repeat the installation and install the web-based Administrator Server components (option 3) on your iManager server. This is required to install the DirXML plug-ins for iManager. After installing the plug-ins, restart Apache using `rcapache2 restart` before the plug-ins will take effect.

After completing the installation, the eDirectory daemon should be automatically restarted. However, if you installed iManager plug-ins, you will be required to manually restart the Apache server, as documented in step 9. After everything has been restarted, iManager is the administrative tool used to configure Identity Manager. Accessing iManager should now show two new categories in iManager's Navigation frame: DirXML and DirXML Utilities. The options available beneath these categories are used to configure the actual data synchronization process and are described later in this chapter.

Installing Remote Loaders and Drivers

With the Identity Manager engine installed, you are ready to start configuring your Identity Manager environment. The first step in doing this is to make sure that the Remote Loader is installed on any systems that will use it. For both Active Directory and NT domain synchronization, the Identity Manager driver and Remote Loader must be installed on an appropriate Domain Controller. The Domain Controller should have the following characteristics:

- Active Directory Domain Controller running Windows 2000 Server with Support Pack 1 and Internet Explorer 5.5 or later
- NT Domain Primary Domain Controller (PDC) running Windows NT 4 with Service Pack 6a or later

To install Remote Loader and Identity Manager driver on a Windows 2000 server running Active Directory, complete the following steps. For more information on performing the same type of installation on an NT 4 server, see the OES Linux online documentation.

1. At the Windows 2000 server that will host the driver, insert the Identity Manager Bundle Edition CD-ROM. After a few moments, the Identity Manager Bundle Edition Installation screen will appear. Click Next.
2. At the License Agreement screen, select the appropriate language to view the license agreement. When you have reviewed the agreement, click I Accept.
3. If necessary, review the Identity Manager overview pages. Click Next to continue to the next overview page, and then Next again to continue the installation.
4. At the Components screen, deselect DirXML Server, DirXML Web Components and Utilities. Then select DirXML Connected System, to install the Identity Manager Remote Loader and Drivers, and click Next.
5. At the Location screen, specify the path to which the Remote Loader will be installed, and click Next. It is usually best to just accept the default path.
6. At the Select Drivers for Remote Loader Install screen, select the Remote Loader Service and the DirXML Driver for Active Directory, and then click Next.
7. Review the information on the Installation Summary screen, and click Finish. You may see a warning about LDAP conflicts. If so, click OK to close the message box.
8. At the Create Shortcut screen, click Yes. This will create a shortcut on your Windows desktop to the DirXML Remote Loader Console.
9. At the Installation Complete screen, click Close.
10. Launch the Identity Manager Remote Loader Configuration Wizard using `dirxml_remote.exe` found in the directory specified in step 5, typically `c:\Novell\RemoteLoader`. At the Welcome page, click Next.
11. At the Command Port screen, click Next. This is the port that will be used by this instance of the remote loader to listen for Identity Manager activity. Novell recommends keeping the default port.
12. At the Configuration File screen, click Next. This is the name and location of the log file that will be used to record Remote Loader configuration options.
13. At the DirXML Driver screen, select Native and make sure that `ADDRIVER.DLL` is listed in the drop-down

Installing Identity Manager on a Secondary eDirectory Tree

Each eDirectory tree that you want to synchronize with Identity Manager must have an Identity Manager driver installed and configured on a replica server of the secondary eDirectory tree. The first Identity Manager driver for eDirectory was installed as part of the Identity Manager engine installation, described previously. The Identity Manager driver installation for eDirectory will vary based on the platform that the host server is running. Identity Manager supports the following operating systems:

- - NetWare 6.0 SP3 or later
- - NetWare 6.5
- - Windows NT/2000
- - Red Hat AS/ES 2.1, AS 3.0
- - SUSE Linux Enterprise Server 8 or 9
- - Solaris 8 or 9
- - AIX 5.2L

For more information on installing the Identity Manager driver in a secondary eDirectory tree, see the OES online documentation.

Configuring an Identity Manager Driver

Now that all the Identity Manager components are in place, you can do the actual Identity Manager driver configuration. This is done through the iManager plug-ins for Identity Manager that were installed previously. You can also use ConsoleOne to do the Identity Manager configuration if desired.

To simplify the configuration process, you can import the preconfigured driver settings that you have copied to your systems as part of the Identity Manager installation process, described previously. To import a preconfigured Identity Manager driver, complete the following steps:

1. Launch iManager from the server where the Identity Manager plug-ins have been installed.
2. Open the DirXML Utilities link in the Navigation frame and click Import Drivers.
3. Select the radio button next to In a New Driver Set, and click Next.
4. Provide the required information and click Next.
 - Name Provide a name for the driver set.
 - Context Specify the context in which you want the driver set object to be created.
 - Server Specify the server object on which Identity Manager is installed.
 - Create a New Partition on This Driver Set Selecting this option will create a new directory partition in which Identity Manager data will be stored, where it can be isolated from the rest of the day-to-day eDirectory activity. Novell recommends that you configure Identity Manager in this way.
5. Select the specific driver configuration file you want to import and click Next. You can select multiple drivers, if desired.
6. Provide the required information to configure the driver and click Next. If you have selected multiple drivers, you will have to fill out the appropriate configuration information for each driver. For more information on the specific information requested by each driver type, see the OES online documentation.
7. Provide the required information to configure administrative rights for the Identity Manager driver and click Next.
 - Click Define Security Equivalence, add Admin, and click OK. This grants the Identity Manager driver security equivalence to Admin in eDirectory so that sufficient rights are granted the driver to perform its synchronization operations.
 - Click Exclude Administrative Roles, add Admin, and click Next. You should add any objects with administrative roles to this list in order to avoid problems with similar objects that may exist in other directories. Typically, administrative roles are specific to a given directory tree and don't need to be synchronized.
8. At the Summary screen, click Finish. You can also click Finish with Overview if you want to view a synopsis of the driver's settings, as shown in [Figure 10.4](#).

Figure 10.4. Identity Manager (DirXML) Overview screen.

Identity Manager Password Synchronization

In addition to the synchronization of data between disparate systems such as eDirectory, Active Directory, and NT domains, Identity Manager Bundle Edition also enables you to synchronize passwords between these systems. Identity Manager Password Synchronization for Windows, known as PasswordSync, allows passwords to be transparently and securely synchronized between eDirectory and the Active Directory/NT domains for which you have Identity Manager drivers configured.

PasswordSync uses filters and agents to capture changes to passwords and securely pass those changes to included systems. Identity Manager is capable of understanding object mappings across systems so that each user object is associated with the proper object in every other system. Because of this, synchronizing passwords across the systems becomes much easier.

The specifics of how PasswordSync is installed depends on the systems involved. For example, because Microsoft clients forward password change requests to their respective Domain Controllers for processing, PasswordSync Filters are installed on all Domain Controllers in Active Directory and NT environments. On the other hand, because Novell clients never send passwords across the network, PasswordSync filters for eDirectory are installed on the client workstation and are part of the Novell clients that ship with OES NetWare.

Unfortunately, because password synchronization with Identity Manager relies on PasswordSync filters and agents communicating the changes throughout the environment, if a password is synchronized through an unsupported mechanism, the synchronization will not occur. One example of this is an LDAP client such as Novell eGuide. If you use an LDAP client to change your eDirectory password, the change will not be synchronized to your Active Directory and/or NT Domain environments because the PasswordSync filters are never involved in the process. Similarly, if a password is changed from a non-Windows environment, the change will not be synchronized.

Bottom line here: Use PasswordSync if you can be confident that password changes will only occur in one of the Windows methods supported by PasswordSync. For example:

- - Workstation running the Novell client
- - Workstation not running the Novell client
- - Windows server or workstation running Microsoft Management Console
- - Windows workstation or server running ConsoleOne
- - Workstation or server running Novell iManager

For more information on configuring and using PasswordSync, see the OES online documentation.

Part III: Open Enterprise Server User Access

[11](#) OES Linux File Storage and Management

[12](#) OES Linux File Access

[13](#) OES Printing Services

Chapter 11. OES Linux File Storage and Management

[Instant Access](#)

[Novell Storage Services](#)

[NSS Data Security](#)

[Backing Up and Restoring Files](#)

Instant Access

Managing Logical Volumes

- - To create, delete, or enlarge a logical volume, use the volume management options in iManager, or the console-based nssmu.
- - To mount/dismount or activate/deactivate a logical volume, use the volume management options in iManager, or the console-based nssmu.
- - To verify or rebuild a logical volume or pool, use the console-based ravsui.

Managing Disk Space

- - To manage file compression, use nsscon to set file compression parameters.
- - To limit users' disk space, use volume management options in iManager.

Managing Files

- - To salvage or purge deleted files, use the NetWare Utilities option in the Novell Client or ConsoleOne.
- - To display information about files and directories, view the NetWare Info tab of the file or directory properties using the Novell Client.

NSS Directory and File Security

- - To view or change filesystem trustee assignments, use the rights command-line utility. The Novell Client and NetStorage can also be used.
- - To view or change directory and file attributes, use chmod or NetStorage.

Backing Up and Restoring Files

- - To back up and restore network files, use nbackup from the server console. For a more comprehensive backup/restore solution, use a third-party backup product that is SMS-compliant.

File storage and management are the core of any network server, and Novell NetWare has long offered the capability to manage files in many ways. The primary tool for file management has been Novell Storage Services (NSS). With OES Linux, Novell has brought this powerful filesystem to the Linux world.

This chapter looks at the various file storage capabilities and options available in OES Linux and discusses the advantages and potential pitfalls of each. This chapter also covers the SMS backup services offered with OES.

Novell Storage Services

Novell Storage Services (NSS) is a powerful storage and filesystem that provides an efficient way to use all the space on your storage devices. NSS cannot be used for the OES Linux root filesystem, which contains the SLES operating system files, but it can be used for any other storage space you would like to allocate.

NSS is now one of many different filesystems offered on Linux platforms. Although every filesystem's primary goal is to provide access to disk storage, each filesystem has its own particular features. NSS is no different and offers a wide range of features not available with any other filesystem.

Some of the main features of NSS are complete integration with eDirectory, extended Access Control Lists (ACLs), rights inheritance and filtering, support for multiple name spaces, and much, much more. Many of those capabilities are only possible through an NSS feature known as a backlink.

With NSS, each file or directory is backlinked to the parent directory. This means that not only does the parent know what objects are beneath it, but the child also knows what parent directories are above it. This feature is unique to NSS and offers several powerful capabilities. One benefit of this is visible when browsing directories with varying permissions. In non-NSS filesystems, all directories are visible even if you do not have permission to enter the directory. With NSS, backlinks are used to ensure directory visibility is confined to just the directories you have access to.

Another benefit is seen when assigning permissions. To provide access to a file several levels deep in a directory tree, NSS only requires that rights be assigned at that specific file or location. There is no need to traverse the tree, either manually or automatically, and assign rights. Through backlinks, NSS automatically determines the visibility of parent directories and ensures that users are able to traverse to the location where rights have been assigned.

NSS also offers many additional capabilities over traditional Linux filesystems. This does not mean that NSS is always the best choice, but understanding the capabilities of NSS should help you to make the right filesystem choice for whatever filesystem needs you may have. NSS is particularly useful in conjunction with other OES components, such as Novell Clustering Services (NCS) and the Novell Client. NSS is a powerful addition to your OES Linux infrastructure, and an important component to understand.

The first concept with which you should become familiar in the NSS filesystem is the volume. An NSS volume is the highest level in the filesystem hierarchy, and is the structure within which directories and files are maintained. From a Linux perspective, a volume is just another term for a filesystem or formatted partition.

NOTE

OES Linux has support for both NSS and NCP volumes. All OES Linux servers (with eDirectory) will have at least one NCP volume, known as SYS. This is actually the `/usr/novell/sys` directory, which is served to NCP-based clients as a volume. This directory contains files used in conjunction with NCP access to the server. More information regarding NCP volumes is available later in this chapter.

OES Linux does not automatically create any NSS volumes. These volumes can be created as needed using iManager or the command-line utility `nssmu`.

The volume is the last link in the NSS chain. [Figure 11.1](#) gives a high-level view of the NSS architecture.

-

NSS partitions A partition is a logical organization of space on a hard disk, and represents the lowest level of organization for disk storage. Partitions prepare space on storage devices to be used in an organized and structured way by defining the ways in which the filesystem will interact with the storage devices.

-

NSS storage pools NSS storage pools are created in partitioned space. A storage pool is a specified amount

NSS Data Security

One of the most important features of NSS is its flexible, yet powerful, security model. This security is integrated with eDirectory and offers comprehensive security management through command-line utilities, NetStorage, or the Novell Client. As mentioned earlier in this chapter, NSS operates in two modes, NetWare mode and Linux mode. NetWare mode requires that eDirectory user accounts be used to access NSS volumes. This allows for integration with eDirectory, and is the only way to provide for the advanced security capabilities described in this section. Linux mode refers to accessing NSS volumes using local user accounts. In this mode, you are limited to the traditional POSIX permissions seen with other Linux filesystems. Information about POSIX permissions can be found in [Chapter 3](#), "Working with SUSE Linux Enterprise Server 9."

With an NSS filesystem in NetWare mode, you can implement two types of security tools in the filesystem, either together or separately, to protect your files:

- **Trustee rights** These are equivalent to entry rights for eDirectory objects. Trustee rights enforce access control that defines the possible actions that can be taken with Volume, Folder, and File objects and who or what can perform those actions.
- **Attributes** Attributes define the characteristics of individual Folder or File objects. Because attributes trump trustee rights, they control the activities of all users, regardless of which trustee rights are assigned.

Filesystem Trustee Rights

Filesystem trustee rights allow eDirectory users and groups to work with files and directories on NSS volumes in specific ways. Each right determines whether a user can do things such as see, read, change, rename, or delete the file or directory. NSS filesystem rights obey inheritance rules just like eDirectory rights. When rights are assigned to a file, they define a user's allowable actions for that file only. When rights are assigned to a directory, they affect a user's allowable actions on not only the directory itself but also everything stored within that directory.

Although filesystem rights are similar in nature to the eDirectory rights for objects and properties (described in [Chapter 8](#), "Users and Network Security"), they are not the same thing. Filesystem rights are separate from eDirectory rights. They affect only how users work with files and directories. eDirectory rights affect how users work with other eDirectory objects.

There are eight filesystem trustee rights. You can assign any combination of those filesystem rights to a user or group, depending on how you want that user or group to work.

[Table 11.2](#) describes the available filesystem rights and how they affect directory and file access.

Table 11.2. Filesystem Rights

FILESYSTEM RIGHT	ABBREVIATION	DESCRIPTION
Read	r	Directory: Allows the trustee to open and read files in the directory. File: Allows the trustee to open and read the file.
Write	w	Directory: Allows the trustee to open and write to (change) files in the directory. File: Allows the trustee to open and write to the file.

Backing Up and Restoring Files

Although current storage technologies, such as RAID, hot-swappable hard drives, and network-attached storage are making servers ever more secure in their capability to maintain data, there are still many ways in which data can be lost or corrupted. For those situations, it is necessary to have a backup of your network data so that lost files can be recovered.

OES Linux provides a data backup-and-restore infrastructure known as Storage Management Services (SMS). SMS makes it possible to copy your network data, including files, directories, the eDirectory database, and even data from other servers and clients, to an offline storage system such as tape or optical disk. With a well-developed backup strategy, you can be confident that you will always have a current copy of your network data, so you can restore files should the unthinkable occur.

There are several network backup solutions for Linux on the market today. Unfortunately, at the time of this writing, none of them builds upon this SMS foundation to deliver a comprehensive backup solution. This means that with third-party backup tools on Linux, you will be able to back up your filesystem, but extended data, like NSS ACLs, cannot be part of that backup. However, SMS is designed with networking environments in mind. Because of this, SMS-compliant backup programs running on other operating systems can effectively back up OES Linux servers. This means that another operating system, NetWare or Windows, is required for an enterprise-level backup solution, but obtaining complete backups is worth the trouble.

OES Linux does include a fairly basic Linux server-based, SMS-aware backup interface called `nbackup`. This utility will back up the data correctly including extended data but it lacks many of the conveniences, such as flexible scheduling options, that third-party products have. This situation shouldn't last long, as third-party vendors are expected to release native Linux backup programs supporting SMS in the near future.

A solid backup strategy is critical to the well-being of your network. The following section describes backup strategies that can be employed to protect your valuable data. Although the majority of these strategies are explained from the perspective of using an enterprise-level backup software program, the essential features of `nbackup` are also discussed.

Planning a Backup Strategy

Planning is critical to developing an effective backup strategy. A well-planned backup strategy will avoid those headaches associated with finding and restoring files if that becomes necessary. It will reduce the time it takes to perform data backups and help keep your network humming along. When planning your backup strategy, consider the following:

- - How frequently should you make backups?
- - What type of medium are you going to use to back up your data?
- - How should you rotate your backup media?
- - Where will your backup copies be stored?
- - How and when will you test the restore procedure?

TIP

Although it is possible to back up eDirectory database files, restoring them is a prescription for major grief. Rather

Chapter 12. OES Linux File Access

[Instant Access](#)

[Introduction to Novell File Access](#)

[NetStorage](#)

[Novell NetDrive](#)

[Novell iFolder](#)

[FTP Server](#)

Instant Access

Using NetStorage

- - NetStorage provides a WebDAV server interface for all OES Linux files and directories.
- - Use any WebDAV-compliant application, such as web browsers, Windows Explorer (My Network Places), or Office 2000 to access OES NetWare files and folders.
- - NetStorage can provide clientless access to iFolder files.
- - NetStorage provides the WebDAV support for the NetDrive client.

Working with NetDrive

- - NetDrive client is available online by searching for neTDrive at <http://support.novell.com/filefinder>.
- - NetDrive supports access to OES Linux files and folders using standard protocols: FTP, WebDAV, or iFolder.

Synchronizing Files with Novell iFolder

- - Synchronize files between remote clients and a centralized iFolder server, so that user data is available anytime, from anywhere.
- - Configure and manage iFolder server through the iFolder management console, available at <https://<iFolder server DNS or IP address>iFolderServer/Admin> after iFolder is installed.
- - Use iFolder client to provide synchronization between the iFolder server and regularly used machines.
- - If you are using a machine for one-time access, use NetStorage to access the iFolder server without having to synchronize all files.
- - Use NetDrive to access the iFolder server without synchronizing the entire directory. Useful when the desktop application is not WebDAV-aware.
- - iFolder access requires that the iFolder server be installed and configured prior to use.

Introduction to Novell File Access

One of the major tenets of Novell's oneNet philosophy is that users should have access to their files and data at any time, from anywhere. To help you reach this goal, OES Linux includes a host of methods for accessing network data.

In keeping with Novell's open-standards approach to network services, these access methods are designed to use Internet standards, web browsers, and thin clients, thereby minimizing the need to add large amounts of workstation software in order to access network resources. Those access methods that do require a client of some sort make installation and configuration as easy as possible, so users can get on with their business.

This chapter takes a look at the new and nontraditional forms of file access available in OES Linux. These include

- NetStorage
- Novell NetDrive
- Novell iFolder
- FTP server

NetStorage

NetStorage provides a transparent WebDAV interface to OES files. Effectively, NetStorage allows you to access files on an OES Linux server without a Novell client. NetStorage is integrated with iFolder, NetDrive, and Virtual Office to make accessing your network files as easy and seamless as possible all without using the traditional Novell Client.

NetStorage leverages a middle-tier architecture, also called XTier, to provide its services. This same architecture is used to support some of the functionality for Novell's ZENWorks line of management solutions.

Installing NetStorage

NetStorage can be installed during the installation of the OES Linux server, or after the fact through YaST. Typically, you will need to install NetStorage only on one OES Linux server in your eDirectory tree, or on one server at each geographical site, although very heavy usage might require more than one per site.

To install NetStorage through YaST, complete the following steps:

1. Access YaST from a terminal using `yast`, or from a graphical environment using `yast2` or the YaST launcher from the application menu.
2. Select the Network Services category in YaST. From within this category, locate and select the NetStorage module. This module will detect that the RPMs for NetStorage are missing and ask if you want to install them. Select Continue to install the necessary packages.
3. At the conclusion of the software installation, SuSEconfig is executed to update the system configuration. When this completes, the configuration of the OES component will begin automatically.
4. At the NetStorage LDAP Server Configuration screen, enter the following information and click Next:
 - Local or Remote Directory Server Select the radio button that indicates whether eDirectory is running on the local server or a remote server.
 - Directory Server Address If a remote eDirectory server is in use, enter the IP address for this server.
 - Admin Name with Context Enter the eDirectory administrator's credentials using fully qualified dot notation, for example, `cn=admin.o=novell`.
 - Admin Password Enter the password for the administrator user.
 - Port Details If necessary, select this button to change the configured ports for the eDirectory server you specified earlier. The default LDAP port for unencrypted communications is 389 and port 636 is used for SSL-encrypted communications.
5. At the NetStorage Configuration screen, enter the required information (see [Figure 12.1](#)), and click Next. You can change these settings after the installation through iManager by opening the NetStorage link and selecting Authentication Domains.
 - (Optional) Enter the iFolder 2 server address Specify the DNS name or IP address of your iFolder 2.x server if you want users to be able to access iFolder data through NetStorage. More information on iFolder is available later in this chapter.
 - Authentication Domain Host Specify the DNS name or IP address of a server in your eDirectory tree that hosts a master or a read/write replica of eDirectory. This does not have to be the server where NetStorage is being installed. NetStorage will use this server to authenticate users when they attempt to log in to NetStorage.

Novell NetDrive

Novell NetDrive enables you to map a network drive to any OES Linux server without using Novell client software. This means that with NetDrive, you can access and modify your files from any workstation using just an Internet connection. After a network drive is mapped, the drive letter that you assigned during the mapping appears in Windows Explorer and functions just like those that are mapped through Novell client. Basically, the capability to map drives has been extracted from the Novell client where it can be used independent of all the other Novell client features. For more information on the Novell client, see [Chapter 4](#), "OES Linux Clients."

NetDrive Prerequisites

NetDrive runs on any Windows workstation, including Windows 95/98/Me and Windows XP/2000/NT. You need only 2MB of available space on your hard drive to install and run the NetDrive client.

WARNING

If you are installing the NetDrive client on a Windows 95 workstation, make sure you have installed the Winsock 2 update from Microsoft. It is available on the Microsoft website.

NetDrive supports three protocols for accessing network files:

- - WebDAV NetDrive integrates with NetStorage to provide a comprehensive file access solution with very little client overhead. NetStorage must be installed and configured prior to using NetDrive with WebDAV.
- - FTP NetDrive can access network files using the standard File Transfer Protocol (FTP). An FTP server must be installed and configured on your network before using NetDrive with FTP. With OES, you can use one of the optional FTP servers, described later in this chapter, to provide this type of access.
- - iFolder NetDrive can access files from your directory on the iFolder server. iFolder must be installed, and your iFolder account configured, prior to using NetDrive with iFolder.

The choice of protocol depends largely on your network environment. One is not preferable to another. Use the protocol that best fits your network strategy.

Using NetDrive

The latest version of the NetDrive client is available by searching on netdrive at <http://support.novell.com/filefinder>. If you need help installing the NetDrive client, see [Chapter 4](#).

With the NetDrive client installed, you can access files on your OES Linux servers using standard Internet protocols. However, not every protocol is supported on every version of Windows.

- - iFolder Windows NT and XP/2000
- - FTP Windows 95, 98, NT, and XP/2000
- - WebDAV (HTTP) Windows 95, 98, NT, and XP/2000
-

Novell iFolder

Novell iFolder gives you automatic, secure, and transparent synchronization of files between your hard drive and the iFolder server, which results in easy access to personal files anywhere, anytime.

Being able to access your files from any computer, in any location, eliminates mistakes and the updating that is frequently necessary when your local files are not accessible over the network.

Novell iFolder has three components:

-

iFolder server software After you have installed the iFolder server software on your server, users can install the iFolder client in order to access their iFolder files. Administrators use the iFolder Management console and the iFolder website to manage iFolder user accounts.

NOTE

The iFolder Management console enables you to perform administrative tasks for all iFolder user accounts. From the iFolder website, iFolder users download the iFolder client. It is also where you can access the Java applet and view your iFolder files from a browser. The iFolder website can, and should, be customized to fit the look and feel of your organization.

-

iFolder client software Novell iFolder client is compatible with Windows 95/98, Windows XP/2000/NT, and Linux workstations. The iFolder client must be installed on every workstation that you will use to access your iFolder files. When the iFolder client is installed, it does three things:

-

It creates a shortcut to your iFolder directory on your desktop. The iFolder directory, which by default on a Windows client is located in My Documents\iFolder\userid\Home, is where you will keep the files you want to synchronize with the iFolder server. When a file is placed in the iFolder directory, it is synchronized out to the iFolder server, from which it can be accessed by all workstations that are logged in to your iFolder account.

-

On Windows workstations, an iFolder icon is placed in the workstation system tray. Right-clicking the system tray icon gives users access to their user-configurable preferences and the iFolder status screen, which displays a history of the transactions that have occurred between the iFolder server and the client.

-

A user account is created on the iFolder server. iFolder user accounts are created automatically when a user downloads and installs the iFolder client. When you log in, iFolder asks you for a username and a password. Next, iFolder prompts you for a passphrase. This passphrase is used to encrypt files that are uploaded to the server.

NOTE

Uninstalling the iFolder client does not delete the associated user account on the iFolder server. This can be done only from the iFolder Management console.

-

iFolder Java applet Use the iFolder Java applet to access iFolder files from a workstation on which the iFolder client is not installed.

FTP Server

Several FTP servers are available for the Linux platform. With SLES, two commonly used FTP servers are Pure-FTP (pure-ftpd) and VSFTP (vsftpd). Both of these FTP servers are included with SLES distributions and may be optionally installed during the OES installation.

The Pure-FTP server is intended to provide fast, lightweight FTP access to a Linux server. It offers a focus on tight integration with the Linux kernel and a standards-compliant and security-aware design.

The VSFTP server, or Very Secure FTP server, is an FTP server that was coded with a focus on security. Given the focus of this server, it is the FTP server most commonly used with SLES and will be the center of this discussion.

Regardless of the server you select, the purpose of an FTP server is to provide a means of easily transferring files over network connections. All File Transfer Protocol (FTP) servers communicate over TCP/IP and should conform to RFC 959. The VSFTP server meets these requirements. When the primary VSFTP server daemon (vsftpd) is started, you can perform file transfers from any FTP client to the OES Linux Server. This is normally done by authenticating as a local user to the FTP server. However, if you are also using the LUM component of OES, FTP users can be configured for redirection back to your Novell eDirectory tree. Without LUM, the FTP server will be limited to authenticating locally stored users only. For more information on LUM, please see [Chapter 8](#), "Users and Network Security."

The VSFTP server is a fully functional FTP server with many features, such as those in the following list. This section provides basic installation and configuration information so that you can use FTP file access with NetDrive.

- - xinetd-based service management The Internet Super Daemon Extended, or xinetd, manages the vsftpd process. This allows xinetd to provide an additional security layer for vsftpd. As incoming requests are encountered, xinetd verifies the request, and if allowed, spawns the vsftpd process. With this integration, FTP service management is performed via the YaST Network Services (inetd) module.
- - Authenticated user access Local user access can be used to provide local and LUM users with complete access to private files. These accounts can be locked into their home directory through the use of a CHROOT jail.
- - Anonymous user access Anonymous user accounts can be set up to provide users with basic access to public files. Using a CHROOT jail, anonymous access can be locked into a specific directory structure to reduce potential security risks.
- - Firewall support If the FTP client is behind a firewall, FTP server supports passive mode data transfer and the configuration of a range of passive data ports.
- - FTP logs The FTP service maintains a log of several activities, including FTP sessions, unsuccessful login attempts, active session details, and system error and FTP server-related messages.

For detailed information on all VSFTP server features, see the VSFTP homepage at <http://vsftpd.beasts.org/>.

Installing FTP Server

The VSFTP server can be installed as an optional component during the OES Linux installation or it can be installed later through YaST. To install VSFTP using YaST:

1. Access YaST from a terminal using yast, or from a graphical environment using yast2 or the YaST launcher from the application menu.

Chapter 13. OES Printing Services

[Instant Access](#)

[Introduction to OES Printing](#)

[Setting Up a Secure Printing Environment](#)

Instant Access

Installing and Configuring iPrint

- - Install iPrint as part of the server installation, or install it after the fact through YaST.
- - Configure the Driver Store, iPrint Manager, and Printer objects through iManager.
- - The Driver Store and iPrint Manager daemons are automatically started after configuration. If necessary, the `/etc/init.d/novell-idsd` and `/etc/init.d/novell-ipsmd` scripts can be used to start and stop the daemons.
- - Use the Manage Printers page in iManager to configure printer objects.

Working with iPrint

- - The iPrint client is required to access and manage iPrint printers. Install the client by going to the iPrint home page on your OES Linux server at `http://<server_IP_address or DNS_name>/ipp`.

Defining Print Options

- - To tell the printer how to print a job (the paper form to use, format, and so on), open iManager and choose Manage Printer. Specify the printer and select the Configurations page to change printer configuration.

Printing Jobs

- - To print files from within an application, simply follow the application's normal printing procedures (making sure the application is configured to print to a network printer).
- - To cancel or move a print job, open iManager and choose Manage Printer. Specify the printer and select Printer Control, Jobs.

Introduction to OES Printing

Along with file sharing, printer sharing was one of the original value propositions of Novell NetWare back in the early 1980s. OES Linux continues this on a Linux platform by delivering a powerful printing solution that allows users to print to any network printer to which they have been given rightseven if that printer is on the other side of the world! OES Linux uses iPrint as its default print environment. iPrint leverages the powerful foundation of Novell Distributed Print Services (NDPS), but puts a web face to printing and removes the dependence on the Novell client for print services. With iPrint, mobile employees, business partners, and even customers can access your printers through existing Internet connections. iPrint uses the Internet Printing Protocol (IPP), an industry standard, to make it possible to print seamlessly over the Internet, thus making location-based printing a reality.

The benefits of IPP include the following:

- - IPP enjoys broad vendor support.
- - IPP works over local networks as well as the Internet.
- - IPP provides encrypted print services via SSL or TLS.
- - IPP provides accessibility to print services from any platform (Windows, Macintosh, Linux, Unix, and so on).

Because iPrint is implemented on the foundation of NDPS, you also get all the advantages of robust network printing services coupled with the interoperability and ease-of-use of an Internet standard. So, through the combination of IPP and NDPS, you gain the following capabilities:

- - Global access to printers managed through eDirectory
- - Web-based printer location tool and driver installation
- - Capability to print from anywhere to anywhere
- - Web-based user controls and printer status
- - Printers don't have to be IPP-aware to function with iPrint

When your iPrint environment is configured, you can enjoy powerful printing options suitable for the web-based business world, such as:

- - Printing across the Internet Remote employees can actually print directly to a printer located at the office because iPrint resources are available as standard web URLs. Simply enter the appropriate URL for a company's print services, locate the printer to which you want to print, and iPrint takes care of the restincluding the installation of the iPrint client software, if necessary.
- - Printing away from "home" Setting up printing when visiting a different company location used to be an ordeal. No more. Now, simply access the company's print services URL, browse to the office at which you are

Setting Up a Secure Printing Environment

iPrint is designed to take full advantage of eDirectory security and ease of management. Setting up a secure printing environment can be done on two levels:

- - Print access control Create a secure printing management infrastructure by assigning users to User, Operator, or Manager roles. This restricts the list of those who can control printers, iPrint Managers, and Driver Stores.
- - Securing iPrint with SSL This option not only encrypts print communications over the wire, but also requires users to authenticate before installing and printing to a printer.

These levels are discussed in the following sections.

Print Access Control

Printer security is ensured through the assignment of the Manager, Operator, and User Access Control roles, and by the strategic placement of printers and printer configurations. For more information on eDirectory access control in general, see [Chapter 7](#).

The access controls for iPrint allow you to specify the access each User, Group, or Container object will have to your printing resources. It is important to remember that all iPrint print roles function independently. For example, assigning someone as a printer manager does not automatically grant said person the rights of a printer user.

In most cases, the default assignments will prevent any problems that this role independence might cause. For example, a printer manager is automatically assigned as a printer operator and user for that printer. Similarly, a printer operator is automatically assigned as a user of that printer as well. You cannot remove the user role from an operator, and you cannot remove the operator and user roles from a manager.

The creator of an iPrint object is automatically assigned to all supported roles for the type of object being created.

You can assign multiple Printer objects to a given printer agent, but simultaneously make different access control assignments to each Printer object. This means that users in different containers can be assigned different trustee rights to the same printer.

PRINTER ROLES

As previously alluded to, three roles are associated with iPrint printing services: Manager, Operator, and User. [Table 13.3](#) describes the rights granted to each role.

Table 13.3. NDPS Print Roles and Their Associated Rights

ROLE	ASSOCIATED RIGHTS
Manager	Tasks performed exclusively by the printer manager are those that require the creation, modification, or deletion of Printer objects, as well as other eDirectory administrative functions. Printer managers are automatically designated as printer operators and users as well, so they can perform all tasks assigned to the operator role. Typical manager functions include the following:

Modifying and deleting Printer objects

Part IV: Open Enterprise Server Web Services

[14](#) OES Foundations

[15](#) OES Web Services

Chapter 14. OES Foundations

[Instant Access](#)

[Apache Web Server](#)

[Tomcat Servlet Engine](#)

Instant Access

Installing Apache Web Server and Tomcat Servlet Engine

- Apache Web Server and Tomcat Servlet engine are installed with most configurations of OES Linux. If necessary, they can also be installed later using YaST.

Managing Apache Web Server

- To manage Apache Web Server, use the httpd.conf and various configuration directories beneath /etc/apache2.
- Apache Web Server can also be managed using the HTTP Server module in YaST.
- Virtual Hosting should be used to add custom content to the existing instance of Apache used for OES administration.
- Use the Apache Server logs to view errors and access attempts. Important log files include
 - /var/log/apache2/access_log
 - /var/log/apache2/error_log

Managing Tomcat Servlet Engine

- Use the Tomcat logs to view configuration information and errors. Important log files for Tomcat are
 - /var/log/apache2/mod_jk.log
 - /var/opt/novell/tomcat4/logs/catalina.out
 - /var/opt/novell/tomcat4/logs/localhost_log.*

This chapter looks at Apache Web Server and Tomcat Servlet Engine. Together, they form the foundation necessary for delivering web services on the OES Linux platform:

- Apache Web Server Apache Web Server is an open-source (read: free) web server that is responsible for serving more than 60% of all web content on the Internet. In OES Linux, Apache provides support for all OES Linux web-based management tools, and support for regular web server functionality for providing web services and applications.
- Tomcat Servlet Engine Tomcat was developed by the same folks who gave us Apache and is used to serve

Apache Web Server

Apache Web Server is the primary HTTP stack provided for OES Linux. Apache is an open-source web server used by more than two-thirds of the Internet's web servers. As such, it runs on all major server platforms and can scale to support thousands of simultaneous connections.

Apache Web Server is a complex and full-featured product, so there is a lot more to it than can be covered here. However, because Apache is an open-source application, almost anything you want to know about it is available on the web. You should take some time to look through the Apache documentation in order to become familiar with architecture and capabilities, particularly if you are going to implement a more complex web environment. The Apache Web Server documentation is available online at <http://httpd.apache.org/docs-2.0>.

Apache Web Server can be used in a few different ways on OES Linux. First, Apache is installed automatically as a dedicated web server to support the administrative tools for OES Linux and its related products and services. You can find all files related to this instance of Apache in the `/etc/opt/novell/httpd/conf.d` directory. This administrative web server supports iManager, Virtual Office, iPrint, and other OES Linux services that need a web interface.

If you are using iFolder, a customized configuration of Apache is required. Normally, this is accomplished by installing iFolder on its own dedicated server (with no other OES components). However, it is possible to install other OES components on the same server. To ensure that iFolder is usable in both configurations, a separate, dedicated instance of Apache is used. The configuration file used by the iFolder instance of Apache can be found in the `/etc/opt/novell/ifolder/conf` directory. A separate binary (`/usr/sbin/httpd2-worker`) is also used for the iFolder version of Apache.

NOTE

The iFolder version of Apache is highly customized and specific to the iFolder process. Configuration files for this instance of Apache should not be modified manually. For more information on iFolder, see [Chapter 15](#), "OES Web Services."

Another way Apache is commonly used with OES is to host your own custom web content. In this situation, you should not load another instance of Apache, but rather customize the administrative instance of Apache to recognize a virtual server, or separate document root directory. This is covered later in this chapter.

When you use iManager, accessible from any web browser, it is the Admin configuration of the Apache Web Server that serves the data between the web browser and OES Linux.

Installing Apache Web Server

If you are interested in using Apache only as the foundation for your OES Linux tools and services, you don't have to do anything to get Apache up and running. The admin server configuration of Apache is installed automatically during most OES Linux installations.

However, if you chose to perform a custom installation of OES, or are adding OES components to an existing SLES9 server, you may want to install Apache manually. To install Apache Web Server manually through YaST, complete the following steps:

1. Access YaST from a terminal using `yast`, or from a graphical environment using `yast2` or the YaST launcher from the application menu.
2. Select the Software category in YaST. (This is typically the category selected by default.) From within the Software category, click on the Install and Remove Software module.
3. Use the Filter drop-down box to select the Selections category.

Tomcat Servlet Engine

As with Apache, Tomcat is an open-source application. (It is also known by its open-source project name, Jakarta. For more information on the Jakarta project, see <http://jakarta.apache.org>.) Its specific function is as a servlet container. A servlet is a server-side program that generates dynamic web pages based upon user input. Tomcat provides a runtime environment within which servlets can execute and be managed. Apache Web Server depends on Tomcat to process servlets and Java Server Pages (JSP).

As with Apache, two instances of Tomcat can be loaded on an OES Linux server. The first is an admin instance that is used in conjunction with the Apache admin server to support the various management tools and other services available with OES Linux. The admin instance of Tomcat is loaded automatically when OES Linux is installed.

The second instance is a public copy that is used in support of web applications that are served from the OES Linux server. You will use this version to build your own web environment.

NOTE

Tomcat provides basic servlet and JSP support for OES Linux. For a more robust web application development environment, Novell offers Novell exteNd Application Server. For more information on Novell exteNd offerings, see the OES Linux online documentation, and visit <http://www.novell.com/solutions/extend/>.

Installing and Configuring Tomcat

Because Tomcat is useless without a web server with which to interoperate, Tomcat is normally installed in conjunction with Apache Web Server. For information on installing Apache and Tomcat, see the Apache installation section earlier in this chapter.

By default, OES Linux installs Tomcat 4 configuration files into the `/etc/opt/novell/tomcat4` directory structure. If a second instance or public version of Tomcat is installed, these configuration files will normally be installed in the `/etc/tomcat` directory.

The admin (OES-specific) version of Tomcat requires no additional configuration in order to be operational. However, it is still a good idea to understand the important configuration files for Tomcat. The following list contains the most important configuration files for the admin instance of Tomcat:

- server.xml Main configuration file for Tomcat. This file is located in the `/etc/opt/novell/tomcat4` directory.
- jk_module.conf The main configuration file for the Jakarta-Apache plug-in. This file is located in the `/etc/opt/novell/httpd/gconf.d` directory.
- workers.properties Contains configuration information that connects servlets to Tomcat worker processes. This file is located in the `/etc/opt/novell/httpd/gconf.d` directory.

The public version of Tomcat uses the same configuration files; however, they are typically located within the `/etc/tomcat` directory. For more information on configuring Tomcat for use outside of OES, refer to the Tomcat documentation.

Managing Tomcat

Tomcat does not require much management with OES as the configuration should be completed by the OES installation, and the Tomcat service should be started automatically at server startup. However, you may encounter a situation where you want to start or stop the Tomcat service manually. To do so with the admin version of Tomcat,

Chapter 15. OES Web Services

[Instant Access](#)

[Novell Virtual Office](#)

[Novell QuickFinder](#)

[Novell eGuide](#)

[Additional OES Linux Web Services](#)

Instant Access

Using Virtual Office

- - Use preconfigured services to make OES Linux files, as well as common services such as NetStorage, iPrint, and email, available through a single portal website.
- - Access Virtual Office at <https://<server name or IP address>/vo>.
- - Configure Virtual Office through Administration links visible within Virtual Office to users with eDirectory administrative rights.
- - Virtual teams are a specialized instance of Virtual Office that you can use to create ad-hoc portals to support a community, group, or team focused on a specific project or topic of discussion.

Working with Novell QuickFinder

- - QuickFinder creates a web search engine for use by internal users (indexes relevant Internet websites) or by external users (indexes your web server information so that it can be effectively searched).
- - QuickFinder can be configured and managed through the QuickFinder Server Manager pages, which are accessible at <https://<server name or IP address>/qfsearch/admin>. Links to this management page are also available via iManager.

Working with eGuide

- - eGuide provides robust and secure LDAP white pages to access company information.
- - Access the eGuide search page at <https://<server name or IP address>/eGuide>.
- - Access the eGuide Administration Utility at <https://<server name or IP address>/eGuide/admin/index.html>.

Novell Virtual Office

Novell Virtual Office allows network administrators to quickly and easily provide browser-based access to network resources. Effectively, Virtual Office enables you to create personalized user portals through which users can access their data and applications from a single website. Not only that, but Virtual Office also provides the capability to create virtual teams, or ad-hoc shared portals that can support a project or any other group that needs access to shared resources.

Virtual Office provides services that allow you to access network resources through the Virtual Office interface. Services are little Java-based servlets or applications that provide access to specific types of network resources. OES Linux includes several default Virtual Office services for accessing network resources and performing common network tasks:

- - NetStorage Provides access to the Novell NetStorage service. NetStorage provides Internet-based access to file storage on an OES server, including access to iFolder. Both NetStorage and iFolder were discussed in [Chapter 12](#), "OES Linux File Access."
- - iPrint Provides access to Internet printing via iPrint. For more information on iPrint, see [Chapter 13](#), "OES Printing Services."
- - Email Provides support for popular email applications and protocols, including Novell GroupWise, Microsoft Exchange, Lotus Notes, Novell NetMail, POP3, and IMAP.
- - eGuide Provides a simplified screen to access phone numbers and other user information stored in eDirectory. eGuide is discussed in more detail later in this chapter.
- - Change Password Links to a page where users can change their password in eDirectory.
- - Web Search Provides integration with a Novell Web Search, or QuickFinder, server. QuickFinder is discussed in more detail later in this chapter.
- - ZENworks Provides integration with Novell ZENworks for Desktops functionality, such as application delivery, through the Virtual Office interface.

Perhaps most important to you as a network administrator, Virtual Office doesn't require any complicated web development or programming. It's pretty much ready to go right out of the box.

Installing Virtual Office

Virtual Office can be installed on a dedicated server using the Novell Virtual Office Server installation pattern or as an optional component during the OES Linux installation. Virtual Office can also be installed later through YaST.

NOTE

For most networks, you will need to install Virtual Office on only one server in each eDirectory tree.

The only requirement for Virtual Office, beyond the minimum requirements for an OES Linux server, is a web browser. To install Virtual Office using YaST, complete the following steps:

Novell QuickFinder

Although QuickFinder isn't a required web service for OES Linux, it is all about making your web resources available to employees and customers as quickly and accurately as possible. Supporting everything from simple internal search solutions to complex search services that you can offer to organizations for a fee, QuickFinder is one of the fastest and most accurate search engines currently available.

Novell QuickFinder, previously called Novell Web Search, offers a powerful, full-text search engine that you can use to add search capabilities to your Internet or intranet websites. These capabilities can be integrated into your Apache Web Server environment through custom search forms and search result pages. These pages can be created from scratch or based on one of the included page templates.

This section introduces you to QuickFinder and its basic installation and configuration. However, for comprehensive information, see the OES Linux online documentation.

QuickFinder Capabilities

With Novell QuickFinder, you can

- Support searching multiple-language indexes from a single interface
- Host search services for multiple organizations
- Organize collections of related files from diverse sources as a single document
- Create custom search, print results, error and response messages and apply them to individual language searches or across all supported languages
- Gather customer metrics by reviewing searches to identify what your customers look for the most
- Improve employee productivity by helping them find information more quickly

Installing QuickFinder

Novell QuickFinder can be installed on a dedicated server using the Novell QuickFinder Server installation pattern or as an optional component during a custom OES Linux installation. QuickFinder can also be installed after the fact through YaST.

To install QuickFinder using YaST, complete the following steps:

1. Access YaST from a terminal using `yast`, or from a graphical environment using `yast2` or the YaST launcher from the application menu.
2. Select the Network Services category in YaST. From within this category, locate and select the Novell QuickFinder module. This module will detect that the RPMs for QuickFinder are missing and ask if you want to install them. Select Continue to install the necessary packages.
3. At the conclusion of the software installation, SuSEconfig is executed to update the system configuration. When this completes, the configuration of the OES component will begin automatically.

Novell eGuide

Novell eGuide is a "white pages" application that provides a simple browser-based interface from which your employees can search through your LDAP directory (such as eDirectory) for all the people, places, and things they may need to locate.

eGuide may look like a standard address book, but it is completely platform- and application-independent. It can be accessed by any authorized user via a standard web browser.

You can use eGuide to search multiple LDAP data sources at the same time. This means that you can provide a unified view of data from disparate LDAP sources.

eGuide is also capable of launching secondary applications depending on the type of search a user runs. For example, when users find the people they are looking for, eGuide allows them to launch whatever type of communication fits their current need: email, instant messaging, and even video conferencing.

Installing eGuide

Novell eGuide can be installed as an optional component during the OES Linux installation, or it can be installed after the fact through YaST.

To install eGuide using YaST, complete the following steps:

1. Access YaST from a terminal using `yast`, or from a graphical environment using `yast2` or the YaST launcher from the application menu.
2. Select the Network Services category in YaST. From within this category, locate and select the eGuide module. This module will detect that the RPMs for eGuide are missing and ask if you want to install them. Select Continue to install the necessary packages.
3. At the conclusion of the software installation, SuSEconfig is executed to update the system configuration. When this completes, the configuration of the OES component will begin automatically.
4. At the eGuide LDAP Server Configuration screen, enter the following information and click Next:
 - Local or Remote Directory Server Select the radio button that indicates whether eDirectory is running on the local server or a remote server.
 - Directory Server Address If a remote eDirectory server is in use, enter the IP address for this server.
 - Admin Name with Context Enter the eDirectory administrator's credentials using fully qualified dot notation, for example, `cn=admin.o=novell`.
 - Admin Password Enter the password for the administrator user.
 - Port Details If necessary, select this button to change the configured ports for the eDirectory server specified above. The default LDAP port for unencrypted communications is 389 and port 636 is used for SSL- encrypted communications.
5. For eGuide to be active, select to restart Apache and Tomcat when prompted.

When the installation is complete, you are ready to configure eGuide for your particular environment.

Configuring eGuide

Additional OES Linux Web Services

OES Linux includes several other pieces to the web services puzzle, including MySQL, and scripting support through Perl and PHP. Although an in-depth discussion of these utilities is beyond the scope of this book, a brief introduction to these services and their capabilities is in order.

MySQL

MySQL is an open-source SQL (Structured Query Language) database program. It is easy to install and use, but offers exceptional power, security, and scalability. In fact, because of its small size and speed, it is an ideal platform for delivering database capabilities to your websites and because it's an open-source application, and free with OES Linux, the potential return on investment (ROI) doesn't get much better.

MySQL runs on a wide variety of operating systems other than Linux, making it ideal for today's heterogeneous network environments. You don't have to learn different database systems just because you have different platforms. MySQL platforms include, in addition to Linux, NetWare, Microsoft Windows NT/2000, Sun Solaris, IBM AIX, FreeBSD, OS/2, and others.

MySQL can be installed during the OES Linux installation, or anytime thereafter through YaST.

Perl and PHP Scripting Support

Common Gateway Interface (CGI) scripting is the most common way for a web server to interact with users. It provides the capability to create dynamic content and increase the sophistication and functionality of your web pages.

In addition to the web application, scripting is also a valuable tool for automating network administrative functions and parsing and generating reports based on network activities. Because of this, Novell offers multiple scripting languages with OES Linux, with the goal of not making you learn yet another coding method in order to get your job done.

The most commonly recognized scripting languages are Perl (Practical Extraction and Report Language) and PHP (Hypertext Preprocessor).

Perl is an open-source language that was originally created specifically to process text. Because of this, it is particularly good at text parsing and report generation. It is also very good at web page generation and task automation.

PHP is a server-side HTML-embedded scripting language. It can be used to create dynamic web pages, collect form data, and receive cookie information. It can also be used for talking to other services through protocols such as IMAP, SNMP, and HTTP. PHP supports a wide range of web servers and databases, but is most commonly used with Apache Web Server and MySQL. This makes it a natural choice for the OES Linux Web services environment.

Both Perl and PHP support for Novell services offered with OES Linux is provided in the Novell Developer Kit (NDK) that is included with OES. For more information on the NDK, see the OES online documentation, and visit <http://developer.novell.com/ndk>.

Part V: Appendixes

[A](#) The Most Essential Linux Commands

[B](#) eDirectory Reference Materials

[C](#) Where to Go for More Information

Appendix A. The Most Essential Linux Commands

If you are new to the world of Linux, working on the command line can seem a daunting challenge. Although there is no substitute for a quality training course and in-depth personal practice and experimentation, sometimes simply finding the right command can be the difference between endless suffering and a quick solution to your problem.

To help ease your transition to the Linux world, this appendix has been compiled with some of the more common and important commands used at the terminal. Please keep in mind that this appendix is certainly not intended to provide every command you will likely need in your command-line work, but if you are struggling for that one important command, you may find this guide useful.

With that in mind, these commands have been organized in the following sections:

- Getting Help
- File Management
- Permissions and Identity
- Viewing Files
- Text Processing
- Finding Files and Text
- Regular Expressions
- Environmental Commands
- Working with Processes
- Troubleshooting Tools
- Compression Utilities
- Networking Utilities
- Working with Filesystems
- System Shutdown and Restart

Getting Help

Perhaps the most important tools on the command line are those that you can use to get help. [Table A.1](#) lists a few of these important tools.

Table A.1. Using Terminal-Based Help Systems

COMMAND	GENERAL USAGE	DESCRIPTION
apropos	apropos STRING	Searches the NAME field of all manual pages. Same as man -k [string].
info	info [OPTIONS] INFO_PAGE	Displays the information pages for the specified command.
man	man [OPTIONS] MANPAGE	Displays the manual pages for the specified command, configuration file, system call, and so on. Common options include -k [string] Searches NAME field of man pages for specified string
whatis	whatis KEYWORD	Displays the NAME field from the man page for the specified keyword.

File Management

File management tools include those used for navigation and general file and directory manipulation. Refer to [Table A.2](#) for these commands.

Table A.2. Filesystem Navigation Commands

COMMAND	GENERAL USAGE	DESCRIPTION
cd	cd DIR	Changes directories.
cp	cp [OPTIONS] SOURCE DEST	<p>Copies files or directories.</p> <p>Common options include</p> <ul style="list-style-type: none"> -d Copy symbolic links -R Copy directories recursively
ln	ln [OPTIONS] SOURCE TARGET	<p>Creates a link between two files.</p> <p>Common options include</p> <ul style="list-style-type: none"> -s Create a symbolic, rather than hard, link
ls	ls [OPTIONS] FILE	<p>Lists directory contents.</p> <p>Common options include</p> <ul style="list-style-type: none"> -a Show all files, including hidden files starting with "." -A Show almost all filesomit "." and ".." -d List directory entries rather than contents -l Display a long listing of contents, including file mode, ownership, and timestamp -R Perform a recursive listing
pwd	pwd	Prints the path of the current working directory.
mkdir	mkdir [OPTIONS] DIR	<p>Creates the specified directory.</p> <p>Common options include</p> <ul style="list-style-type: none"> -p Create parent directories if

Permissions and Identity

Your ability to manipulate files and directories at the command line is directly limited by your identity and the permissions available to that identity. [Table A.3](#) lists commands that can be used to adjust file-level permissions, and commands used to temporarily change your identity.

Table A.3. Permissions and Identity Commands

COMMAND	GENERAL USAGE	DESCRIPTION
Chgrp	chgrp GROUP FILE	Changes file and directory group ownership.
Chmod	chmod [OPTIONS] MODE FILE	Changes access permissions on files and directories on native Linux filesystems.
Chown	chown [OPTIONS] OWNER[:GROUP] FILE	Changes file and directory user and group ownership.
Su	su [OPTIONS] USERNAME	Substitutes current user credentials with the specified user's identification. Common options include - Causes a complete login process to be performed using the new user identification
Sux	sux [OPTIONS] USERNAME	Performs an su to the new user credentials, but also creates an Xauthority file necessary for accessing the local X server. Common options include - Causes a complete login process to be performed using the new user identification
whoami	whoami	Displays current user identification.

Viewing Files

When working on the command line, you will most likely encounter plenty of opportunities for viewing log files, configuration files, or another other type of normal file. [Table A.4](#) lists commands used for this purpose.

Table A.4. Commands Used to View Files

COMMAND	GENERAL USAGE	DESCRIPTION
cat	cat FILE	Concatenates files and displays output on standard out (typically the screen).
head	head [OPTIONS] FILE	Displays the first 10 lines of text from the specified file. Common options include -[N] Displays the first N number of lines
less	less FILE	Paging utility used to display text files.
more	more FILE	Paging utility used to display text files.
od	od [OPTIONS] FILE	Displays the specified file in octal mode. Common options include -h Hexadecimal display
strings	strings FILE	Prints text strings four characters long or longer from binary files.
tail	tail [OPTIONS] FILE	Displays the last 10 lines of text from the specified file. Common options include -[N] Displays the last N amount of lines -f Follows an active log file

Text Processing

Manipulating text files can be a time-consuming process if done manually. The commands in [Table A.5](#) are commonly used to manipulate the contents of text files. These commands normally work by outputting the data to standard out (otherwise known as the screen), so to capture these changes, you normally redirect the output to another text file using the greater-than sign (>). For example:

```
sort /etc/passwd > /tmp/users.txt
```

Table A.5. Commands Commonly Used to Process Text Files

COMMAND	GENERAL USAGE	DESCRIPTION
expand	expand FILE	Converts tab characters to spaces in the specified file.
joe	joe FILE	Text-editing utility.
nl	nl FILE	Assigns line numbers and displays the specified file.
pr	pr [OPTIONS] FILE	Formats a text file for printing.
sort	sort FILE	Alphabetically sorts and displays the specified file.
unexpand	unexpand FILE	Converts spaces to tab characters in the specified file.
uniq	uniq FILE	Displays all unique lines in the specified file.
vi	vi FILE	Text-editing utility. Use vimtutor for an introduction to this utility.
wc	wc [OPTIONS] FILE	Returns the number of lines, words, and characters in the specified file.

Finding Files and Text

There are several methods for finding files and text within files from a terminal. [Table A.6](#) contains the more common methods used.

Table A.6. Commands Used to Find Files and Text Within Files

COMMAND	GENERAL USAGE	DESCRIPTION
egrep	egrep [OPTIONS] PATTERN [FILE]	<p>Searches the contexts of text files for the specified pattern. The pattern specified for egrep must be created using extended regular expressions.</p> <p>Common options include</p> <ul style="list-style-type: none"> -i Ignore case for searches -r Recursive search for matching files <p>For example:</p> <pre>egrep (root admin) /etc/*</pre> <p>Syntax for extended regular expressions is available in Table A.8.</p>
fgrep	fgrep [OPTIONS] PATTERN [FILE]	<p>Searches the contexts of text files for the specified pattern. The pattern specified for fgrep will be interpreted literally and not translated as a regular expression. This allows for searching on such things as wildcard characters (*, ?).</p> <p>Common options include</p> <ul style="list-style-type: none"> -i Ignore case for searches -r Recursive search for matching files <p>For example:</p> <pre>fgrep '*15' /etc/crontab</pre>
find	find [PATH] EXPRESSION	<p>Searches a directory structure for a specific file or files matching the specified expression.</p> <p>Common expression options include</p> <ul style="list-style-type: none"> -name File name search

Regular Expressions

Searching for text within files requires the use of regular expressions. Regular expressions can be either common regular expressions or extended regular expressions. An introduction to both types of expressions can be seen in [Tables A.7](#) and [A.8](#).

Not all utilities recognize both types of regular expressions, so be sure you are using the correct form for whatever utility you are using.

Table A.7. Common Regular Expressions

COMMAND	EXAMPLE	DESCRIPTION
.	test. matches test1, test2, test3	Matches any single character.
*	test* matches test, testt, testtt	Matches zero or more occurrences of the preceding character.
^	^test matches any line containing test as the first word	Matches the following characters if they are found at the beginning of a line.
\$	test\$ matches any line containing test as the final word	Matches the preceding characters if they are found at the end of a line.
\	test\\$ matches test\$	Used to escape metacharacters used in other regular expressions.
[...]	test[1234] matches test1, test2, test3, and test4 test[1-4] also produces the same results	Matches one character in the specified range of possible characters.
[^...]	test[^1234] matches test5, test6, test7, and so on. test[^1-4] also produces the same results	Matches one character not found in the specified range of characters.

Table A.8. Extended Regular Expressions

COMMAND	EXAMPLE	DESCRIPTION
?	test? matches tes, test	Matches zero or one occurrences of the previous character.
+	test+ matches test, testt, testtt	Matches one or more occurrences of the previous character.
{ }	test{ 2} matches testt test{ 1,4} matches test, testt, testtt, testttt	Matches the specified number of occurrences of the previous character. Two numbers separated by a comma are used to specify a

Environmental Commands

The environment of your terminal is based on a number of factors, such as what shell you are running, and what customizations you have performed. In-depth customization of your shell is quite complex, and entire books are devoted to the subject. [Table A.9](#) lists a few of the common ways to adjust your working environment.

Table A.9. Environmental Commands

COMMAND	GENERAL USAGE	DESCRIPTION
alias	alias NAME=VALUE	Constructs an alias used to execute custom commands. (When no parameters are specified, current aliases are displayed.) For example: <pre>alias ll='ls -l'</pre>
echo	echo TEXT	Displays the line of text entered as a parameter. (Commonly used in shell scripts.)
env	env	Displays exported environment variables.
export	export VARIABLE	Exports the specified variable for use in subsequent subshells or command environments.
set	set	Displays environment variables and shell functions.
unset	unset VARIABLE	Removes an environment variable from memory.

Working with Processes

Interacting with user-level and system-level processes is an important aspect of administering Linux. [Table A.10](#) identifies many of the tools used for this purpose.

Table A.10. Commands for Working with Processes

COMMAND	GENERAL USAGE	DESCRIPTION								
at	at TIME COMMAND	Executes a one-time command at the specified time.								
bg	bg %JOB	<p>Sends the specified job number to the background.</p> <p>Note: Pressing Ctrl+Z will suspend the current foreground process. After the process has been suspended, it can be moved to the background using bg. To start a process in the back- ground, append an ampersand (&) to the end of the command. For example:</p> <pre>updatedb &</pre>								
crontab	crontab [OPTIONS] USERNAME	<p>Used to adjust or view a user's crontab. User crontabs contain commands scheduled for execution on a regular basis.</p> <p>Common options include</p> <ul style="list-style-type: none">-e Edit user's crontab-l List user's crontab								
fg	fg %JOB	Brings the specified job number to the foreground.								
jobs	jobs	Displays job numbers for all back- ground processes.								
kill	kill [SIGNAL] PID	<p>Sends a kill signal to the specified process.</p> <p>Common kill signals are</p> <table><tr><td>SIGHUP (1)</td><td>Hang-up</td></tr><tr><td>SIGINT (2)</td><td>Interrupt</td></tr><tr><td>SIGTERM (15)</td><td>Terminate (default)</td></tr><tr><td>SIGKILL (9)</td><td>Absolute kill</td></tr></table>	SIGHUP (1)	Hang-up	SIGINT (2)	Interrupt	SIGTERM (15)	Terminate (default)	SIGKILL (9)	Absolute kill
SIGHUP (1)	Hang-up									
SIGINT (2)	Interrupt									
SIGTERM (15)	Terminate (default)									
SIGKILL (9)	Absolute kill									
killall	killall [SIGNAL] PROCESS	Sends the specified kill signal to all processes using the designated process name.								

Troubleshooting Tools

Troubleshooting any operating system can involve a whole suite of specialized software. However, sometimes you just need a quick tool to report specific aspects of your computer. [Table A.11](#) contains some of these utilities found in Linux environments.

Table A.11. Common Troubleshooting Tools

COMMAND	GENERAL USAGE	DESCRIPTION
dmesg	dmesg	Displays the kernel ring buffer.
free	free	Displays the amount of free and used memory on the system.
hwinfo	hwinfo	Queries and displays detected hardware.
iostat	iostat [OPTIONS] INTERVAL COUNT	Displays CPU statistics and input/output statistics on block devices (hard disks). Common options include -d Print device utilization -t Print time for each report -x Print extended statistics
lsof	lsof [OPTIONS]	Lists currently open files. Common options include -b Find open files on the specified filesystem mount point
ltrace	ltrace [OPTIONS] COMMAND	Traces library calls made by a process. Common options include -c Count time and calls, and return a summary upon completion -p Used to attach to a running process
sitar	sitar	Comprehensive reporting tool used to generate a report documenting the entire running environment. The report file can be located in the /tmp/sitar-<SERVER-NAME>

Compression Utilities

Compression utilities are a necessity in a Linux environment. [Table A.12](#) contains a list of the main tools used in compression tasks.

Table A.12. Compression Utilities

COMMAND	GENERAL USAGE	DESCRIPTION
gzip	gzip FILE	Utility used to compress files. (Commonly used to compress tar archives.) Files compressed with gzip usually have a .gz extension.
gunzip	gunzip FILE.gz	Utility used to uncompress gzip files. (Same as gzip -d.)
bzip2	bzip2 FILE	Utility used to compress files. (Utilizes a different algorithm than gzip. Also used to compress tar archives.) Files compressed with bzip2 usually have a .bz2 extension.
bunzip2	bunzip2 FILE.bz2	Utility used to uncompress bzip2 files. (Same as bzip2 -d.)

Networking Utilities

Most networking utilities are somewhat standard across operating systems. [Table A.13](#) contains the most commonly used Linux networking utilities.

Table A.13. Networking Utilities

COMMAND	GENERAL USAGE	DESCRIPTION
dig	dig HOST	Utility used to look up DNS information for the specified host.
ftp	ftp HOST	File Transfer Protocol client utility used to transfer files to and from FTP servers.
ifconfig	ifconfig [OPTIONS]	Utility used to display and configure network interface cards. Common options include -a Display all configured devices
ifdown	ifdown INTERFACE	Script used to stop the specified network interface card.
ifup	ifup INTERFACE	Script used to start the specified network interface card.
netstat	netstat [OPTIONS]	Displays network statistics. Common options include -r Show routing table -n Do not resolve host names -s Display network statistics
ping	ping HOST	Utility used to test network connectivity using ICMP packets directed to the specified host.
route	route	Displays or modifies the current IP routing table.
ssh	ssh HOST	Secure shell client used to open a terminal session on a remote SSH server.
tar	tar [OPTIONS] FILE	Tape or disk archive utility used to

Working with Filesystems

The majority of your filesystem-level tasks can be accomplished from directly within YaST. If necessary, these same tasks can be accomplished from the command line using the tools in [Table A.14](#).

Table A.14. Commands Used to Create and Manage Filesystems

COMMAND	GENERAL USAGE	DESCRIPTION
df	df [OPTIONS]	<p>Displays disk usage statistics for all mounted filesystems.</p> <p>Common options include</p> <p>-h Return output in human readable form</p>
du	du [OPTIONS] [PATH]	<p>Displays disk usage statistics for the specified path.</p> <p>Common options include</p> <p>-h Return output in human readable form</p> <p>-s Provide a summary of the specified directory</p>
fdisk	fdisk DEVICE	Used to modify the partition table for fixed disks.
fsck	fsck [OPTIONS] PARTITION	<p>Utility used to check and repair a Linux filesystem. This utility should be used with care and after ensuring that appropriate backup measures have been taken.</p> <p>Common options include</p> <p>-a Automatically repair the filesystem</p> <p>-r Interactively perform the repair operation</p> <p>-V Produce verbose output of the operation</p> <p>For information on advanced repair options for fsck, including filesystem-specific options, see <code>man fsck</code>.</p>
fuser	fuser [OPTIONS] PATH	Used to identify users or processes currently using a specific filesystem

System Shutdown and Restart

Although it's not often necessary, you may find a reason to occasionally restart or shut down your server. [Table A.15](#) contains these commands.

Table A.15. Commands for Changing the State of the System

COMMAND	GENERAL USAGE	DESCRIPTION														
halt	halt	Shuts down the computer.														
init	init [RUNLEVEL]	<p>Changes the current runlevel to the specified runlevel.</p> <p>Possible runlevels are</p> <table><tr><td>0</td><td>System halt</td></tr><tr><td>1,S,s</td><td>Single-user mode</td></tr><tr><td>2</td><td>Local multiuser, minimal networking</td></tr><tr><td>3</td><td>Full multiuser with networking</td></tr><tr><td>4</td><td>Not used</td></tr><tr><td>5</td><td>Full multiuser with networking and graphical environment</td></tr><tr><td>6</td><td>System reboot</td></tr></table>	0	System halt	1,S,s	Single-user mode	2	Local multiuser, minimal networking	3	Full multiuser with networking	4	Not used	5	Full multiuser with networking and graphical environment	6	System reboot
0	System halt															
1,S,s	Single-user mode															
2	Local multiuser, minimal networking															
3	Full multiuser with networking															
4	Not used															
5	Full multiuser with networking and graphical environment															
6	System reboot															
reboot	reboot	Restarts the computer.														
runlevel	runlevel	Displays previous and current runlevel. (If the previous runlevel is N, runlevel has not been switched since startup.)														
shutdown	shutdown [OPTIONS] time	<p>Used to shut down or restart a Linux machine.</p> <p>Common options include</p> <ul style="list-style-type: none">-h Halt, or shut down computer-r Reboot computer <p>For example:</p> <pre>shutdown -h now</pre>														

Appendix B. eDirectory Reference Materials

eDirectory is an extremely complex environment. Fortunately, it is largely self-sufficient. Most of the day-to-day tasks of maintaining and protecting directory data are handled automatically and transparently. Not only does eDirectory have many built-in integrity features, but it also employs several background processes that keep the directory environment stable and healthy.

eDirectory Background Processes

This section provides a look at the main background processes that do all the heavy lifting associated with eDirectory operations. These processes are

- Database initialization
- Flat cleaner
- Janitor
- Replica sync
- Replica purger
- Limber
- Backlinker
- Schema sync
- Time sync

When you use the various eDirectory monitoring and repair tools, of which some were discussed in [Chapter 7](#), "Novell eDirectory Management," and more are discussed later in this appendix, these background processes and their effects are what you monitor and repair. For this reason, it's a good idea to know a little bit about what you are looking at.

Database Initialization

The Database Initialization (DB Init) background process is automatically initiated whenever the file system is mounted on the eDirectory server. It also executes whenever the eDirectory database is opened or when eDirectory is reloaded. DB Init is responsible for

- Verifying the usability of the eDirectory database files on this server
- Scheduling the running of other eDirectory background processes
- Initializing the various global variables and data structures used by eDirectory
- Opening the eDirectory database files for use by the version of eDirectory running on this server

DSTrace provides the capability to monitor the DB Init process directly

DSTrace with iMonitor

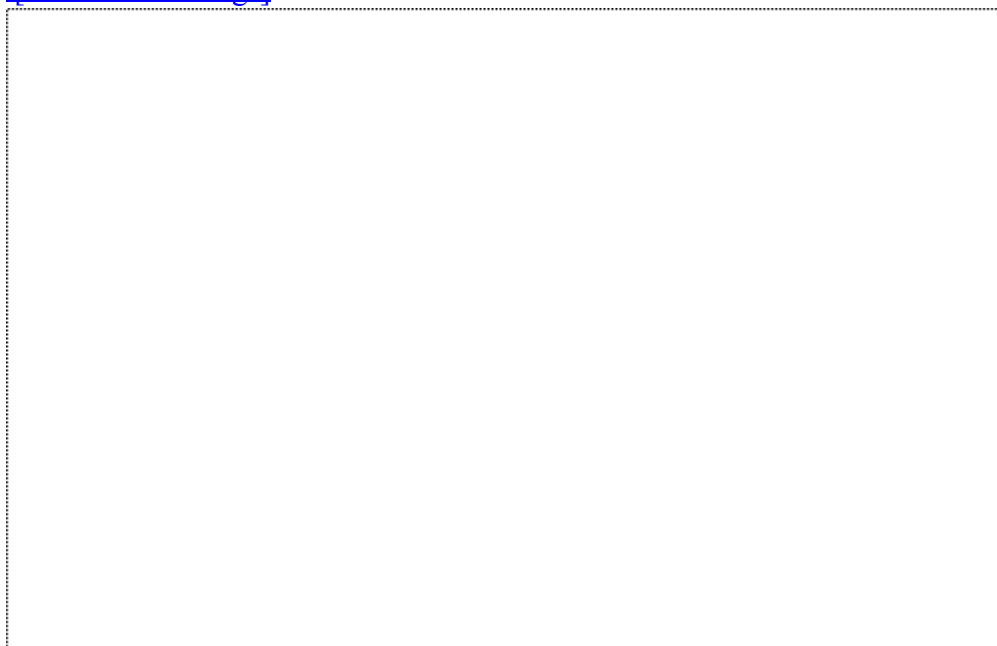
Now that you have been introduced to the most common eDirectory processes, it's important that you know how to keep track of the health and general operation of those processes. To do this you can use iMonitor. iMonitor is presented in [Chapter 5](#), "OES Management Tools," as one of the principal management tools for OES Linux. However, this section focuses on the iMonitor options for monitoring eDirectory processes and activities. Refer to [Chapter 5](#) for information on iMonitor installation, general interface, and additional capabilities. For detailed feature information, see the OES Linux online documentation.

iMonitor is a web-based replacement for several of the console-based management utilities used with previous versions of NetWare, including DSBrowse, DSTrace, and DSDiag. Because the eDirectory processes discussed previously run on each eDirectory server, iMonitor provides a server-level view of eDirectory health as opposed to a tree-level view. You can view the health of processes running only on the server from which you are running iMonitor. To view another server, launch iMonitor from that server.

Prior to using DSTrace from iMonitor, you must configure the utility and specify the activity that you want to monitor. This is accomplished from the Trace Configuration page, shown in [Figure B.1](#).

Figure B.1. Trace Configuration page in iMonitor.

[\[View full size image\]](#)



When you go into Trace Configuration, you will see four new links in the left navigation frame:

- - Trace Configuration This is the default view you will see when entering the Trace Configuration page. From this page, you can define the server-based eDirectory events and processes that you want to trace. The following configuration options are available from this page:
 - - Trace On/Off Enables/disables DSTrace monitoring. When DSTrace is enabled, you will see a Trace button (big lightning bolt) in iMonitor's header frame that you can use to view the active trace (see [Figure B.2](#)).

Figure B.2. Active DSTrace view in iMonitor.

Repairing eDirectory with DSRepair

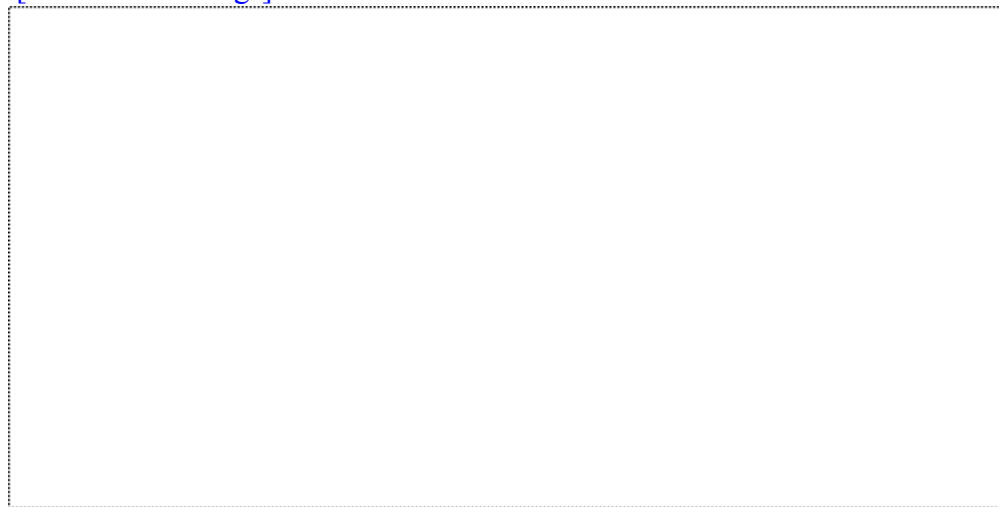
Every database needs a tool for repairing inconsistencies when they occur. DSRepair has been serving in this capacity as long as eDirectory has existed. Even though Novell is shifting its focus toward web-based tools, DSRepair is still essential for working on your eDirectory on a day-to-day basis. DSRepair offers three main groups of features:

- - Unattended full repair
- - eDirectory monitor operations
- - eDirectory repair operations

To load DSRepair on your OES Linux server, execute `ndsrepair` at the server console. This utility requires at least one startup switch to determine what operation will be performed. These startup switches can be confusing at first, but the man page and utility usage screen are available to help with command syntax. To access the `ndsrepair` utility usage screen, execute `ndsrepair` with the `-help` startup option, as shown in [Figure B.4](#).

Figure B.4. The `ndsrepair --help` screen.

[\[View full size image\]](#)



All DSRepair operations and results can be logged to a file for review. The default log file is `/var/nds/ndsrepair.log`. The `ndsrepair` utility also supports a startup option (`-F`) used for configuring the name and location of this log file.

The following three sections describe the features available in each of the three main categories of DSRepair operations: Unattended Full Repair, eDirectory Monitor Operations, and eDirectory Repair Operations.

Unattended Full Repair (`ndsrepair U`)

The Unattended Full Repair (UFR) is probably the most-used feature in DSRepair although the huge database sizes now being supported by eDirectory might change that. UFR checks for and repairs most non-critical eDirectory errors in the eDirectory database files of a given server. UFR is activated by executing `ndsrepair` with a `U` startup parameter.

The UFR performs seven primary operations each time it is run, none of which requires any intervention by the administrator. These operations are described in [Table B.2](#). During some of these operations, the local database is backed up. UFR builds a temporary file to hold database files and then copies them into the new file. That

eDirectory Errors

There are a wide variety of error codes and conditions that can be reported in your Novell eDirectory environment. Specific information on each error is available in the Novell online documentation. You can also link to error code information from iMonitor by clicking an error from directly within the DSTrace screen. eDirectory error codes are usually displayed in decimal numbers.

NOTE

Because the eDirectory is designed as a loosely consistent database, temporary errors are normal. Don't be alarmed if temporary error conditions come and go as part of normal eDirectory operation. However, if errors persist for a significant period of time, you might need to take some action to resolve the problem.

eDirectory error codes can be categorized as shown in the following subsections.

eDirectory Agent Errors

These are the error codes with which you will typically work when tackling some eDirectory problem. They come in two ranges:

- 601 to 799
- 6001 or higher

The 6001 range is new to recent versions of eDirectory. These error codes identify errors originating in the eDirectory Agent running on your OES Linux server.

Operating System Errors

Certain eDirectory background processes or operations, such as network communications or time synchronization, require the use of functionality provided by the operating system on which eDirectory is running. These functions can return operating-systemspecific error codes to eDirectory. These error codes are passed on to the eDirectory process or operation that initiated a request.

Generally, negative numbers identify all eDirectory-generated operating system errors, whereas positive numbers identify all other operating system errors:

- 1 to 256 eDirectory-generated operating system errors
- 1 to 255 Operating systemgenerated errors

This is an esoteric distinction for your information only. During trouble- shooting, you should treat occurrences of operating system errors with the same number, whether negative or positive, as relating to the same event.

Client Errors

In some cases, an eDirectory server will function as a directory client in order to perform certain background processes or operations. This can result in client-specific error codes being returned to eDirectory background processes and operations. The eDirectory client that is built into ndsd generates these error codes. Client error codes fall in the range of 301 through 399.

Appendix C. Where to Go for More Information

Open Enterprise Server for Linux is a very large and complex product. It also includes a large number of services that many traditional Linux or NetWare administrators might not have seen before. Fortunately, Novell products are so popular and widely used that an entire support industry has developed around them. If you are looking for more information about Novell, Open Enterprise Server (for Linux or NetWare), or SUSE Linux, you're in luck. You can go to a variety of places for help.

This appendix points you toward sources of information that will help you:

- - Dig further into Novell's vision and strategy
- - Find more information on OES Linux configuration and troubleshooting
-

Get more information on the new products and services offered with SUSE Linux Enterprise Server

General Novell Product Information

The main Novell information number, 1-800-NETWARE, is your inroad to all types of presales information about Novell or its products.

By calling this number, you can obtain information about Novell products, the locations of your nearest resellers, pricing information, and phone numbers for other Novell programs.

To access the online documentation for any current Novell product, visit Novell's online documentation site:

<http://www.novell.com/documentation/>

Novell on the Internet

A tremendous amount of information about Novell and SUSE products, both official and unofficial, is available on the Internet. Officially, you can obtain the latest information about Novell and SUSE from Novell's website. Novell also helps support several user forums that deal specifically with SLES, OES, or generally with networking and computers.

Novell's website is

www.novell.com

Novell user forums can be found at

support.novell.com/forums/

These user forums are not managed directly by Novell employees, but offer users access to a wide variety of information and files dealing with SUSE Linux, NetWare, and other Novell products, such as GroupWise. You can receive information such as technical advice from sysops (system operators) and other users, updated files and drivers, and the latest patches and workarounds for known problems in Novell products.

The Novell sites also provide a database of technical information from the Novell Technical Support division, as well as information about programs such as Novell Training classes and Novell Users International (NUI). You can also find marketing and sales information about the various products that Novell produces.

Novell Cool Solutions

Novell Cool Solutions is another way of hooking up with Novell's broad community of users. It offers product reviews, tips and tricks, and the opportunity to share knowledge with Novell users all over the world.

Information is organized by solution set and by product, and there is a lot to see. To check out Novell's Cool Solutions, visit the website:

<http://www.novell.com/coolsolutions>

Novell AppNotes

Novell's Research Department produces a monthly publication called Novell AppNotes. Each issue of AppNotes contains research reports and articles on a wide range of topics. The articles delve into topics such as network design, implementation, administration, and integration. AppNotes are available online:

<http://developer.novell.com/research>

Novell Connection

Novell Connection magazine is a bimonthly publication devoted to providing the latest and greatest strategy overviews, product reviews, and customer case studies. Novell Connection is written at a higher level than AppNotes, so it is ideal for helping you communicate IT messages to business executives.

Best of all, Novell Connection is available online free! To check out the latest edition of Novell Connection, or check out past issues, visit the website:

<http://www.novell.com/connectionmagazine/>

Novell Technical Support

If you encounter a problem with your network that you can't solve on your own, there are several places you can go for help:

- - Try calling your reseller or consultant.
- - Go online, and see if anyone in the online forums or Usenet forums knows about the problem or can offer a solution. The knowledge of the people in those forums is broad and deep. Don't hesitate to take advantage of it, and don't forget to return the favor if you know some tidbit that might help others.
- - Call Novell technical support. You might want to reserve this as a last resort, simply because Novell technical support charges a fee for each service request (a service request can involve more than one phone call). The fee depends on the product for which you're requesting support.

When you call technical support, make sure you have all the necessary information ready, such as the versions of SUSE Linux or NetWare and any utility or application you're using, the type of hardware you're using, network or node addresses and hardware settings for any workstations or other machines being affected, and so on. You'll also need a major credit card if you don't already have a technical support contract.

Novell's technical support department also offers online information, technical bulletins, downloadable patches and drivers, and so on. They also offer the Novell Professional Resource Suite (NPRS). The NPRS is a collection of CDs, offered on a subscription basis, that includes the support knowledge base, product evaluation library, and other useful support tools to help you support your Novell environment and plan for the future.

To get in touch with Novell's technical support, or to find out more about Novell's technical support options, visit Novell's support website:

<http://support.novell.com>

To open a technical support incident call, call 1-800-858-4000.

Novell Ngage

Because of the complexity of many of the modern information solutions offered by Novell, it's not practical to assume that you are going to stay on top of every aspect of your modern network environment. To help you cope, and make the most of your investment in Novell solutions, Novell offers comprehensive, fee-based consulting services, marketed under the brand Novell Ngage, to help you with system planning and design, custom development, and comprehensive solution implementation.

For more information about Novell Ngage services, visit the Ngage website:

<http://www.novell.com/ngage/>

DeveloperNet: Novell's Developer Support

Developers who create applications designed to run on Linux or NetWare might qualify to join Novell's program for professional developers, called DeveloperNet. Subscription fees for joining DeveloperNet vary, depending on the subscription level and options you choose. If you are a developer, some of the benefits you can receive by joining DeveloperNet are

- - Novell development CD-ROMs, which contain development tools you can use to create and test your applications in NetWare environments
- - Special prereleases and early access releases of upcoming Novell products
- - Special technical support geared specifically toward developers
- - Discounts on various events, products, and Novell Press books

For more information, visit Novell's developer website:

<http://developer.novell.com>

You can also apply for membership or order an SDK by calling 1-800-REDWORD.

Novell Training Classes and Certification

If you are looking for a way to learn about Linux, NetWare, or any other Novell service or product, in a classroom setting, Novell Training offers a variety of options with hands-on labs and knowledgeable instructors. As a pioneer of IT training and certification, Novell has a broad range of training opportunities available. For the most current information on Novell Training courses, certifications and materials, visit the Novell Training website:

<http://www.novell.com/training/>

Novell classes are taught at more than a thousand Novell Training Service Partners (NTSPs) throughout the world. They are also taught at more than 100 NATPs (Novell Academic Training Partners), which are universities and colleges that teach these courses.

Certification courses offer an excellent way to get some direct, hands-on training in just a few days. Classes are also available in Computer-Based Training (CBT) form, in case you'd rather work through the material at your own pace, on your own workstation, than attend a class.

These classes also help prepare you if you want to become certified as a CNE, signifying that you are a Novell professional.

The Novell CNE program provides a way to ensure that networking professionals meet the necessary criteria to adequately install and manage NetWare networks. To achieve CNE status, you take a series of exams on different aspects of NetWare. In many cases, you might want to take the classes Novell offers through its NTSPs to prepare for the exams, but the classes aren't required.

The classes and exams you take depend somewhat on the level of certification you want to achieve. Although certain core exams are required for all levels, you can also take additional electives to achieve the certification and specialization you want.

The following levels of certification are available:

- - CNA (Certified Novell Administrator) This certification is the most basic level. It prepares you to manage your own NetWare network. It does not delve into the more complex and technical aspects of NetWare. If you are relatively new to NetWare, the class offered for this certification is highly recommended.
- - CNE (Certified Novell Engineer) This certification level ensures that you can adequately install, manage, and support NetWare networks. While pursuing your CNE certification, you "declare a major," meaning that you choose to specialize in a particular Novell product family. For example, you can become a NetWare 6 CNE or a GroupWise CNE. There are several exams (and corresponding classes) involved in achieving this level of certification.
- - Master CNE This certification level allows you to go beyond CNE certification. To get a Master CNE, you declare a "graduate major." You will delve deeper into the integration- and solution-oriented aspects of running a network than you would at the CNE level.
- - CNI (Certified Novell Instructor) CNIs are authorized to teach NetWare classes through NTSPs. The tests and classes specific to this level ensure that the individual taking them will be able to adequately teach others how to install and manage NetWare.
-

Certified Linux Professional This certification is geared toward IT experts interested in administering SUSE Linux networks. This is a comprehensive course covering a wide range of Linux concepts. Obtaining this

Advanced Technical Training

In addition to standard Novell Training courses, Novell also offers highly technical and specialized seminars known as Advanced Technical Training (ATT). ATT is the most advanced training offered by Novell, and covers a wide range of advanced topics including support issues, in-depth architectural reviews, and advanced enterprise solutions. ATT is an excellent way to keep your skills, and those of your IT staff, in top form so that you are able to effectively support emerging technologies and complex network infrastructure solutions. For more information on ATT, visit the website:

<http://www.novell.com/training/pep/att/def.html>

Novell Users International

Novell Users International (NUI) is a nonprofit association for networking professionals. With more than 250 affiliated groups worldwide, NUI provides a forum for networking professionals to meet face to face, to learn from each other, to trade recommendations, or just to share war stories.

By joining the Novell user group in your area, you can build relationships and network with other Novell professionals in your area, attend regularly scheduled local user group meetings for training, and have access to regional NUI conferences, held in different major cities throughout the year. Best of all, there is usually little or no fee associated with joining an NUI user group.

For more information or to join an NUI user group, visit the NUI website:

<http://www.nuinet.com>

You can also call 1-800-228-4NUI.

Network Professional Association

If you've achieved, or are working toward, your CNE certification, you might want to join the Network Professional Association (NPA). The NPA is an organization for network computing professionals, including those who have certified as networking professionals in Novell, Microsoft, Cisco, and other manufacturers' products. Its goal is to keep its members current with the latest technology and information in the industry.

If you're a certified CNE, you can join the NPA as a full member. If you've started the certification process, but aren't finished yet, or if you are a CNA, you can join as an associate member (which gives you all the benefits of a full member except for the right to vote in the NPA's elections).

When you join the NPA, you can enjoy the following benefits:

- - Local NPA chapters (more than a hundred worldwide) that hold regularly scheduled meetings that include presentations and hands-on demonstrations of the latest technology
- - A subscription to Network Professional Journal
- - Access to NPA Labs that contain up-to-date technology and software for hands-on experience
- - Job postings
- - NPA's own professional certification programs
- - Discounts or free admission to major trade shows and conferences, including NPA's own conferences

For more information on the NPA, visit the website:

<http://www.npanet.org>

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[\\$ regular expression](#)

[* \(asterisk\)](#)

[__ regular expression](#)

[+ regular expression](#)

[. \(dot\) regular expression](#)

[/bin directory](#)

[/boot directory](#)

[__ kernel-related files 2nd 3rd](#)

[/boot/grub directory](#)

[/boot/grub file](#)

[/boot/grub/menu.1st file 2nd 3rd](#)

[/dev directory](#)

[/etc directory](#)

[/etc/apache/server-tuning.conf file](#)

[/etc/apache2/conf.d directory](#)

[/etc/apache2/errors.conf file 2nd](#)

[/etc/apache2/listen.conf file](#)

[/etc/apache2/mime.types file 2nd 3rd](#)

[/etc/apache2/vhosts.d directory](#)

[/etc/dhcp.conf file](#)

[/etc/fstab file](#)

[/etc/group file 2nd](#)

[/etc/init.d directory 2nd 3rd 4th 5th](#)

[/etc/init.d/boot script 2nd](#)

[/etc/init.d/rc script](#)

[/etc/inittab file 2nd 3rd 4th](#)

[/etc/modprobe.conf file](#)

[/etc/opt/novell/httpd/conf.d directory](#)

[/etc/pam.d directory 2nd](#)

[/etc/passwd file 2nd 3rd](#)

[/etc/shadow file 2nd](#)

[/etc/sysconfig directory](#)

[__ synchronizing files with application configuration files 2nd](#)

[/etc/sysconfig Editor module \(YaST\)](#)

[/etc/sysconfig/kernel file 2nd](#)

[/etc/tomcat directory](#)

[__ configuration files 2nd](#)

[/etc/X11/XF86Config file](#)

[/etc/xinetd.d/vnc file](#)

[/home directory](#)

[/lib directory](#)

[/media directory](#)

[/mnt directory](#)

[/opt directory](#)

[/proc directory 2nd 3rd](#)

[/root directory](#)

[/sbin directory](#)

[/srv directory](#)

[/sys directory 2nd 3rd](#)

Index

[\[SYMBOL\]](#) [\[A\]](#) [\[B\]](#) [\[C\]](#) [\[D\]](#) [\[E\]](#) [\[F\]](#) [\[G\]](#) [\[H\]](#) [\[I\]](#) [\[J\]](#) [\[K\]](#) [\[L\]](#) [\[M\]](#) [\[N\]](#) [\[O\]](#) [\[P\]](#) [\[Q\]](#) [\[R\]](#) [\[S\]](#) [\[T\]](#) [\[U\]](#) [\[V\]](#) [\[W\]](#) [\[X\]](#) [\[Y\]](#) [\[Z\]](#)

[absolute paths 2nd](#)

access

[_NSS volumes 2nd 3rd 4th](#)

[access control lists 2nd 3rd 4th 5th 6th](#)

access controls

[iPrint 2nd](#)

[iPrint Driver Store 2nd](#)

[iPrint Manager 2nd](#)

[printer roles 2nd 3rd](#)

[access logs \(Apache Web Server\) 2nd](#)

[access_log file \(Apache Web Server\)](#)

[Account module \(PAM\)](#)

activating

[_NSS storage pools](#)

[using iManager](#)

[using nsscon](#)

[_NSS volumes](#)

[ACU \(Automatic Client Upgrade\) 2nd 3rd 4th](#)

[Address Restrictions page \(iManager\) 2nd](#)

administration tasks

 kernel management

[_boot directory files 2nd](#)

[custom kernel, compiling 2nd](#)

[modules 2nd 3rd](#)

[monitoring SLES with HMS 2nd](#)

[configuring HMS 2nd 3rd](#)

[installing HMS 2nd 3rd](#)

[process management 2nd 3rd](#)

 startup procedure

[bootloader configuration 2nd 3rd](#)

[startup procedures](#)

[daemon initialization 2nd 3rd 4th](#)

[overview 2nd](#)

 troubleshooting SLES

[kernel configuration 2nd](#)

[Rescue mode 2nd](#)

[system log files 2nd](#)

[updating OES Linux 2nd 3rd 4th 5th](#)

[YaST modules 2nd](#)

[Misc 2nd](#)

[Network Devices 2nd 3rd](#)

[Network Services 2nd 3rd 4th](#)

[Security and Users 2nd](#)

[Administration Utility \(eGuide\) 2nd 3rd](#)

administrative tasks

 YaST modules

[Hardware 2nd](#)

[Software 2nd 3rd](#)

[System 2nd 3rd](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[b-trees](#)

background processes (eDirectory)

[Backlinker 2nd](#)

[Database Initialization \(DB Init\) 2nd](#)

[Flat Cleaner 2nd](#)

[Janitor 2nd](#)

[Limber 2nd](#)

[Replica Purger 2nd](#)

[Replica Sync 2nd](#)

[Schema Sync](#)

[Time Sync](#)

[Backlinker background process 2nd](#)

backups 2nd 3rd 4th [See also [SMS](#)]

[host servers, preparing 2nd](#)

[iPrint database](#)

[media rotation 2nd](#)

[medium, choosing 2nd](#)

[nbackup utility 2nd 3rd 4th 5th](#)

[planning strategy 2nd 3rd 4th 5th 6th 7th 8th 9th](#)

[schedules 2nd](#)

[storage location considerations 2nd](#)

[System Backup module](#)

[target servers, setting up 2nd](#)

banners

[printer banners 2nd 3rd](#)

BASH shell 2nd

[tracking commands](#)

[bg command](#)

bind operations, LDAP clients 2nd 3rd 4th 5th

biometric authentication

biometrics [See also [NMAS](#)]

[Boot from Hard Disk option \(GRUB menu\)](#)

[Boot Loader Configuration module](#)

[Boot Options option \(GRUB menu\) 2nd](#)

boot process [See [startup procedure](#)]

[Booting option \(Installation Settings page\)](#)

Bottom Panel

[GNOME](#)

[Bourne shell](#)

[Browse entry right](#)

browsers [See [web browsers](#)]

[bunzip2 command](#)

[bzip2 command](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[C shell](#)

[CA Management module \(YaST\)](#)

[canceling print jobs](#)

[cat command](#)

[catalina.out log file \(Tomcat\)](#)

[categories](#)

[__ NMAS graded authentication](#)

[cd command 2nd](#)

[CD Creator module \(YaST\)](#)

[CD-ROM Drives module](#)

[CDE \(Certified Directory Engineer\) certification](#)

[certification 2nd 3rd 4th](#)

[CGI \(Common Gateway Interface\) scripts](#)

[Change Source of Installation module](#)

[chgrp command](#)

[child partitions](#)

[__ strategy for 2nd 3rd](#)

[chmod command](#)

[chmod utility 2nd 3rd 4th 5th 6th](#)

[Choose Language module](#)

[chown command](#)

[chown utility 2nd](#)

[CIMOM \(Common Information Model Object Manager\) daemon](#)

[CLE \(Certified Linux Engineer\) certification](#)

[CLE \(Certified Linux Professional\) certification](#)

[clearances](#)

[__ NMAS graded authentication](#)

[Client page \(Novell Client properties\)](#)

[clients](#)

[__ iFolder client, installing 2nd 3rd](#)

[iPrint](#)

[__ in Linux environment](#)

[__ in Windows environment](#)

[__ installing 2nd 3rd 4th](#)

[__ updates 2nd](#)

[__ NetDrive client 2nd](#)

[__ NetIdentity 2nd 3rd 4th 5th](#)

[__ NCI client 2nd](#)

[__ NMAS client 2nd](#)

[Novell Client \[See \[Novell Client\]\(#\)\]](#)

[__ Red Carpet clients 2nd 3rd 4th 5th 6th 7th](#)

[__ SSH clients for Windows](#)

[cluster convert commit command](#)

[Cluster Manager view \(iManager\) 2nd 3rd](#)

[Cluster Options page \(iManager\)](#)

[Cluster Properties page \(iManager\) 2nd 3rd 4th 5th 6th 7th 8th](#)

[cluster resources](#)

[cluster-aware applications](#)

[cluster-enabled NSS pools](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[Daemon Restart settings \(NRM\)](#)

daemons

[definition of](#)

[Database Initialization \(DB Init\) background process 2nd](#)

[Date and Time module](#)

deactivating

[NSS storage pools](#)

[using iManager](#)

[using nsscon 2nd](#)

[NSS volumes](#)

default

[cluster port number](#)

[OES Linux installations 2nd](#)

 port assignments

[web services 2nd](#)

[Virtual Office services 2nd](#)

[Default Capture page \(Novell Client properties\)](#)

[Default Runlevel option \(Installation Settings page\)](#)

[Default System installation patter 2nd](#)

default-server.conf file

[Alias directive 2nd](#)

[Apache Web Server configuration](#)

[Delete entry right](#)

[Delete Inhibit attribute](#)

deleting

[cluster-enabled pools/volumes](#)

[local groups](#)

[local user accounts](#)

[LUM groups from eDirectory](#)

[LUM users from eDirectory](#)

[NSS storage pools](#)

[NSS volumes](#)

[replicas 2nd](#)

[descriptors 2nd](#)

desktops

[FVWM 2nd 3rd 4th](#)

[GNOME 2nd 3rd 4th](#)

[components 2nd](#)

[help system 2nd](#)

[KDE 2nd 3rd 4th](#)

[help 2nd](#)

[DeveloperNet 2nd](#)

[device authentication](#)

[df command 2nd](#)

DFS (Distributed File System)

[OES platform support](#)

[DHCP Server module \(YaST\) 2nd 3rd](#)

DHCP servers

[configuring 2nd](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[echo command](#)

[eDirectory](#)

[architecture 2nd 3rd 4th 5th 6th](#)

[background processes](#)

[Backlinker 2nd](#)

[Database Initialization \(DB Init\) 2nd](#)

[Flat Cleaner 2nd](#)

[Janitor 2nd](#)

[Limber 2nd](#)

[Replica Purger 2nd](#)

[Replica Sync 2nd](#)

[Schema Sync](#)

[Time Sync](#)

[error codes 2nd 3rd](#)

[agent errors 2nd](#)

[client errors](#)

[operating system errors 2nd](#)

[indexing 2nd](#)

[LDAP Services for eDirectory 2nd](#)

[bind operations 2nd 3rd 4th 5th](#)

[LDAP Group object, configuring 2nd 3rd 4th](#)

[LDAP Server object, configuring 2nd 3rd 4th](#)

[login controls 2nd 3rd 4th](#)

[address restrictions 2nd](#)

[intruder lockout configuration 2nd 3rd](#)

[login restrictions 2nd](#)

[password restrictions](#)

[time restrictions 2nd](#)

[login server, specifying](#)

[management](#)

[ConsoleOne 2nd](#)

[iManager \[See \[iManager\]\(#\)\]](#)

[iMonitor \[See \[iMonitor\]\(#\)\]](#)

[monitoring](#)

[DSRepair 2nd 3rd](#)

[DSTrace utility 2nd 3rd 4th 5th](#)

[external references, checking 2nd 3rd](#)

[ndstrace 2nd](#)

[object health 2nd 3rd 4th](#)

[replica sync status 2nd 3rd 4th](#)

[schema inconsistencies 2nd](#)

[time sync status 2nd 3rd](#)

[traces 2nd 3rd](#)

[version of eDirectory, verifying 2nd](#)

[name context for login, specifying](#)

[objects](#)

[Common Name \(CN\)](#)

[Container objects](#)

[Context](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[fan-out failover 2nd](#)

[Fax module](#)

[fdisk command](#)

Feeble Virtual Windows Manager [See [FVWM](#)]

[fg command](#)

[fgrep command](#)

[FHS \(Filesystem Hierarchy Standard\)](#)

file access

[iFolder](#)

[accessing 2nd 3rd](#)

[account information 2nd 3rd](#)

[client, installing 2nd 3rd](#)

[components 2nd](#)

[installing 2nd 3rd 4th](#)

[Management console 2nd 3rd 4th 5th 6th 7th](#)

[prerequisites 2nd](#)

[NetDrive 2nd 3rd 4th 5th 6th 7th 8th](#)

[adding sites 2nd](#)

[configuring 2nd 3rd 4th 5th](#)

[protocols supported 2nd 3rd](#)

[system requirements](#)

[NetStorage 2nd](#)

[accessing files 2nd 3rd](#)

[configuring 2nd](#)

[installing 2nd 3rd 4th](#)

[file compression 2nd 3rd 4th](#)

[file copy process, OES Linux installation 2nd](#)

[file descriptors 2nd](#)

[file globbing 2nd](#)

file system indexes (QuickFinder)

[creating 2nd 3rd](#)

files

 backups [See [backups](#)]

 compressing

[utilities 2nd](#)

 finding

[command-line tools 2nd 3rd](#)

[management commands 2nd](#)

 NSS file attributes

[compared with trustee rights 2nd](#)

[core attributes 2nd](#)

[POSIX representations 2nd](#)

[setting with /sbin/attrib](#)

[setting with chmod 2nd 3rd](#)

[setting with NetStorage 2nd](#)

[purging 2nd 3rd](#)

 remote access

[NFS \(Network File System\) 2nd 3rd 4th](#)

[Samba 2nd 3rd 4th](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

gateways

[iPrint](#)

General page (QuickFinder Server Manager)

[search site settings](#) 2nd 3rd

[services settings](#) 2nd 3rd

General settings (vsftpd.conf) 2nd

Global Settings page (iFolder Management console) 2nd

Global Settings page (QuickFinder Server Manager) 2nd 3rd

GNOME desktop 2nd 3rd

[components](#) 2nd

[help system](#) 2nd

[gnome-terminal graphical shell](#)

GNU Bourne-Again Shell [See [BASH shell](#)]

[graded authentication](#) 2nd 3rd 4th

grafting

[eDirectory trees](#) 2nd

[GRand Unified Bootloader \(GRUB\)](#) 2nd 3rd

[Grand Unified Bootloader \(GRUB\) boot menu](#) 2nd 3rd 4th 5th

[graphical shells](#) 2nd 3rd

[Graphics Card and Monitor module](#)

[greater-than \(\[closangbrkt\]\) metacharacter](#)

[grep command](#)

Group objects

[creating](#) 2nd

[grpadd utility](#)

[grpdel utility](#)

[GRUB \(Grand Unified Bootloader boot menu\)](#) 2nd 3rd 4th 5th

[GRUB \(GRand Unified Bootloader\)](#) 2nd 3rd

[GRUB Root Partition](#)

[GUI](#)

[components](#) 2nd 3rd 4th

[FVWM desktop](#) 2nd 3rd

[GNOME desktop](#) 2nd 3rd

[KDE desktop](#) 2nd 3rd

[remote graphical sessions](#) 2nd

[Xfree86](#) 2nd 3rd 4th

[gunzip command](#)

[gzip command](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[halt command](#)

hard disks

[file compression 2nd 3rd 4th](#)

[restricting user disk space 2nd](#)

hardware

[detection process, OES Linux installation](#)

[kernel configuration values, analyzing 2nd](#)

[Hardware Information module](#)

[Hardware modules \(YaST\) 2nd](#)

hardware requirements

[NCS installation 2nd 3rd](#)

[head command](#)

Header frame

[iManager](#)

[iMonitor](#)

[Novell Remote Manager](#)

Health Monitoring

[configuration requirements](#)

Health Monitoring Services [See [HMS](#)]

[help](#)

[command-line tools 2nd](#)

[console-based 2nd 3rd 4th 5th 6th](#)

[graphical systems 2nd 3rd 4th](#)

[ndsmerge utility](#)

[Hidden attribute 2nd](#)

[hierarchical databases](#)

[High Availability module](#)

[history command](#)

HMS

[\(Health Monitoring Services\)](#)

[configuring 2nd 3rd](#)

[installing 2nd 3rd](#)

[HMS\) 2nd](#)

[Host Name and Name Server option \(Network Address Setup page\)](#)

[Host Names module \(YaST\)](#)

[HTTP Interface Management settings \(NRM\)](#)

[HTTP Logs settings \(NRM\)](#)

HTTP Server module

[virtual hosts, creating 2nd](#)

[HTTP Server module \(YaST\)](#)

[Apached configuration files, editing 2nd](#)

[document root directory, changing 2nd](#)

httpd.conf file

[Apache Web Server configuration](#)

httpstkd daemon

[logs](#)

[restarting](#)

[hwinfo command 2nd](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[I/O redirection](#) 2nd

[IDE DMA Mode module](#)

[identity](#)

[command-line tools](#) 2nd

[Identity Manager](#)

[attribute mappings](#)

[components](#) 2nd 3rd

[configuring drivers](#) 2nd 3rd

[installing](#)

[drivers](#) 2nd 3rd 4th 5th

[engine](#) 2nd

[Remote Loader Service](#) 2nd 3rd

[PasswordSync](#) 2nd 3rd

[idsd-template.conf file](#)

[idsd.conf file](#)

[iPrint Driver Store configuration](#)

[ifconfig command](#)

[ifdown command](#)

[iFolder](#)

[accessing](#) 2nd 3rd

[account information](#) 2nd 3rd

[and Apache Web Server](#) 2nd

[client, installing](#) 2nd 3rd

[components](#) 2nd

[configuration requirements](#)

[installing](#) 2nd 3rd 4th

[Management console](#) 2nd

[Global Settings](#) page 2nd

[Reporting](#) page 2nd

[System Monitoring](#) page

[User Management](#) page 2nd

[NetDrive support](#)

[OES platform support](#)

[port assignment](#)

[prerequisites](#) 2nd

[ifup command](#)

[iManager](#) 2nd

[Cluster Manager view](#) 2nd 3rd

[cluster-enabled NSS pools, creating](#) 2nd 3rd

[configuration requirements](#)

[creating Print Manager](#)

 DSTrace [See [DSTrace utility](#)]

[eDirectory](#)

[object health, ensuring](#) 2nd 3rd 4th

[timestamps, repairing](#)

[eDirectory trees](#)

[renaming](#) 2nd

[frames](#) 2nd

[Health Monitoring Services \(HMS\), configuring](#) 2nd

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[Janitor background process 2nd](#)

Java Virtual Machine [See [JVM](#)]

jk_module.conf file

[Tomcat Servlet Engine](#)

[jobs command](#)

[joe command](#)

[Joystick module](#)

js

[<version number sb italic](#)

[\[clanbr\] sb close angle bracket](#)

[\[closangbrkt\] sb close angle bracket](#)

[iPrint Manager sb iPrint Managers](#)

[magazine title sb italics](#)

JVM (Java Virtual Machine)

[OES platform support](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

K Desktop Environment [See [KDE](#)]

KDE

[components](#) 2nd

[help](#) 2nd

[KDE \(K Desktop Environment\)](#) 2nd 3rd

[KDE System Guard](#)

[Kerberos Client module \(YaST\)](#)

[kernel](#) 2nd

[/boot directory files](#) 2nd 3rd

[configuration values, analyzing](#) 2nd

[custom kernel, compiling](#) 2nd

[error messages, searching](#)

[loading into memory](#) 2nd 3rd

[modules](#) 2nd 3rd

[parameters](#) 2nd 3rd

[version number](#) 2nd 3rd

[kernel-source package](#)

[Keyboard Layout option \(Installation Settings page\)](#)

[Kicker \(KDE\)](#)

[kill command](#) 2nd 3rd 4th

[killall command](#) 2nd

[Konqueror](#) 2nd

Konqueror web browser

[VNC connections](#)

[Konsole graphical shell](#)

[Korn shell](#)

[ksysguard command](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[Language option \(Installation Settings page\)](#)

[LDAP 2nd 3rd](#)

[port assignment](#)

[searching LDAP directory \[See \[eGuide\]\(#\)\]](#)

[ldap admin dn parameter \(smb.conf\)](#)

[LDAP Client module \(YaST\)](#)

[LDAP Contextless Login page \(Novell Client properties\)](#)

[LDAP Group object](#)

[configuring 2nd 3rd](#)

[ldap passwd sync parameter \(smb.conf\)](#)

[LDAP Server module \(YaST\)](#)

[LDAP Server object](#)

[configuring 2nd 3rd 4th](#)

[LDAP Services for eDirectory 2nd](#)

[bind operations 2nd 3rd 4th 5th](#)

[LDAP Group object, configuring 2nd 3rd 4th](#)

[LDAP Server object, configuring 2nd 3rd 4th](#)

[ldap suffix parameter \(smb.conf\)](#)

[Leaf objects](#)

[organization considerations 2nd](#)

[less command](#)

[less paging utility](#)

[less-than \(<\) metacharacter](#)

[libldap.so library](#)

[libldap_r.so library](#)

[libnss_nam](#)

[libnss_nam library](#)

[Limber background process 2nd](#)

[Links service \(Virtual Office\)](#)

[Linux](#)

[kernel 2nd](#)

[logging in to 2nd 3rd 4th 5th 6th 7th 8th 9th 10th](#)

[local account files 2nd 3rd 4th 5th 6th](#)

[login process 2nd 3rd 4th](#)

[root administrator account 2nd 3rd](#)

[switching identities 2nd](#)

[Linux Config object 2nd](#)

[Linux mode \(NSS\)](#)

[Linux User Management](#)

[configuration requirements](#)

[OES platform support](#)

[Linux User Management \(LUM\) 2nd 3rd](#)

[Linux User Management module \(YaST\)](#)

[Linux Workstation object](#)

[listen.conf file](#)

[ll command](#)

[ln command](#)

[Load Vendor Driver CD module \(YaST\)](#)

[Loading cluster resource state](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[Mail Transfer Agent module \(YaST\)](#)

[maintenance mode \(NSS storage pools\) 2nd](#)

[major number \(kernel\)](#)

[man command](#)

[man pages 2nd 3rd 4th 5th](#)

[Manage Hardware \(NRM\)](#)

[Manage Linux \(NRM\)](#)

[Manage NCP Services \(NRM\)](#)

[Management console \(iFolder\) 2nd](#)

[Global Settings page 2nd](#)

[Management Console \(iFolder\)](#)

[Reporting page 2nd](#)

[System Monitoring page](#)

[Management console \(iFolder\)](#)

[User Management page 2nd](#)

[management tools](#)

[command-line tools 2nd](#)

[ConsoleOne 2nd 3rd](#)

[iManager](#)

[iMonitor](#)

[Novell Remote Manager](#)

[Welcome Pages 2nd](#)

[Manager role \(iPrint\)](#)

[Manual Installation option \(GRUB menu\)](#)

[map command 2nd](#)

[Map Designer \(iPrint\) 2nd 3rd 4th 5th 6th](#)

[mapped drives](#)

[publishing website content](#)

[mapping](#)

[network drives](#)

[NetDrive 2nd 3rd 4th 5th 6th 7th 8th](#)

[printers 2nd 3rd 4th 5th 6th](#)

[Master CNE certification](#)

[master node](#)

[tolerance settings 2nd](#)

[transmit frequency settings 2nd](#)

[Master replicas](#)

[changing to Read/Write](#)

[Master Resource Control script](#)

[Memory Test option \(GRUB menu\)](#)

[Memtest-86](#)

[menu.1st file 2nd 3rd](#)

[merging](#)

[partitions 2nd](#)

[trees 2nd](#)

[MIME types, adding to web servers 2nd 3rd](#)

[mime.types file 2nd 3rd](#)

[mingetty program](#)

[Minimum Graphical System \(without KDE\) installation pattern](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[named daemon](#)

[nameconfig utility](#)

Name Services

[with LUM 2nd](#)

[name-based virtual hosts 2nd 3rd 4th](#)

nameconfig utility

[enabling secure LDAP connections with LUM 2nd](#)

[namgroupadd utility](#)

[namgroupdel utility](#)

[namgrouplist utility](#)

[namgroupomod utility](#)

naming

[eDirectory tree](#)

NAMS

[configuring 2nd](#)

[namuseradd utility](#)

[namuserdel utility](#)

[namuserlist utility](#)

[namuserod utility](#)

[namutils.inp file](#)

Native File Access

[OES platform support](#)

[NATPs \(Novell Academic Training Partners\)](#)

Navigation frame

[iManager](#)

[iMonitor](#)

[Novell Remote Manager](#)

[nbackup utility 2nd 3rd 4th 5th](#)

NCIMan (Novell Client Install Manager)

[Novell Client upgrades 2nd 3rd 4th 5th](#)

NCP

 volumes

[sharing local directories as 2nd](#)

[SYS 2nd 3rd](#)

NCP (NetWare Core Protocol)

[NSS volume access 2nd 3rd 4th](#)

[port assignment](#)

NCP Server

[configuration requirements](#)

[OES platform support](#)

[sharing local directories as NCP volumes 2nd](#)

[NCP Server module \(YaST\)](#)

NCP volumes

[mount point](#)

NCS

[\(Novell Cluster Services\)](#)

[architecture 2nd](#)

[benefits 2nd](#)

[cluster resources](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

objects

[cluster resources](#)

Group object

[creating 2nd](#)

[LUM-related objects 2nd 3rd 4th](#)

Organizational Role object

[creating 2nd](#)

[RBS \(Role-Based Services\) objects 2nd](#)

User object

[creating 2nd 3rd](#)

User Template object

[creating 2nd](#)

objects (eDirectory)

[Common Name \(CN\)](#)

[Container objects](#)

[Context](#)

[Distinguished Name](#)

[Leaf objects](#)

[organization considerations 2nd](#)

[rules governing 2nd](#)

[troubleshooting inconsistencies 2nd 3rd 4th](#)

[od command](#)

OES

[core components 2nd](#)

[reasons for using 2nd](#)

services

[platform support 2nd 3rd 4th 5th](#)

OES Linux

[installing 2nd](#)

[component configuration 2nd 3rd 4th 5th 6th 7th 8th 9th 10th](#)

[configuring installation process 2nd 3rd 4th 5th 6th 7th 8th](#)

[default installations 2nd](#)

[eDirectory planning 2nd 3rd](#)

[file copy process 2nd](#)

[filesystem creation 2nd](#)

[GRUB boot menu 2nd 3rd 4th 5th](#)

[hardware prerequisites 2nd](#)

[Installation Settings page 2nd 3rd 4th](#)

[installation source, creating 2nd 3rd](#)

[installation types 2nd](#)

[manual installations](#)

[network preparation 2nd](#)

[partition planning 2nd 3rd](#)

[patterns 2nd 3rd 4th 5th 6th 7th](#)

[remote installations over VNC 2nd](#)

[server hardware, planning 2nd](#)

[verifying installation 2nd](#)

[post-installation tasks 2nd 3rd 4th 5th 6th](#)

[updating 2nd 3rd 4th](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

Package Management

[OES platform support](#)

packages

[Install and Remove Software module \(YaST\)](#)

[kernel-source](#)

PAM

[integration with LUM \(Linux User Management\) 2nd](#)

[LUM-enabled services 2nd 3rd](#)

[PAM \(Pluggable-Authentication Modules\) 2nd 3rd 4th 5th](#)

[pam_nam module 2nd 3rd 4th](#)

[Parent Process ID \(PPID\)](#)

Partitioner (YaST)

[invoking](#)

[Partitioner module](#)

[Partitioning option \(Installation Settings page\)](#)

[partitions 2nd](#)

[creating 2nd](#)

[non-NSS partitions 2nd](#)

[merging 2nd](#)

[mounting 2nd](#)

[moving 2nd 3rd](#)

[NSS partitions](#)

[planning 2nd 3rd](#)

[repair operations 2nd 3rd](#)

[time sync status, verifying 2nd 3rd](#)

[passdb backend parameter \(smb.conf\)](#)

[passwd utility](#)

[password authentication](#)

[Password module \(PAM\)](#)

[Password Restrictions page \(iManager\)](#)

passwords

 Identity Manager [See [Identity Manager](#)]

[Universal Password \(NMASS\) 2nd 3rd 4th 5th](#)

[PasswordSync \(Identity Manager\) 2nd 3rd](#)

[Patch CD Update module](#)

[patterns \(OES Linux installation\) 2nd 3rd 4th 5th 6th 7th](#)

performance tuning

[Apache Web Server 2nd](#)

Perl

[OES platform support](#)

[permissions 2nd 3rd 4th](#)

[command-line tools 2nd](#)

[setting 2nd 3rd](#)

[special permissions 2nd 3rd](#)

[viewing 2nd](#)

[Phone Answering Machine module](#)

PHP

[OES platform support](#)

pico

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[QuickFinder 2nd](#)

[capabilities 2nd](#)

[configuration requirements](#)

[indexes](#)

[creating 2nd 3rd](#)

[default settings, configuring 2nd 3rd](#)

[generating](#)

[scheduling events 2nd](#)

[installing 2nd 3rd](#)

[managing](#)

[general search site settings 2nd 3rd](#)

[general service settings 2nd 3rd](#)

[Index Management page](#)

[index search site settings 2nd 3rd](#)

[opening Server Manager](#)

[print search sites settings 2nd](#)

[print services settings](#)

[search service settings 2nd](#)

[search site settings 2nd 3rd](#)

[security site settings 2nd](#)

[synchronization settings](#)

Quickfinder

[OES platform support](#)

QuickFinder

[search sites 2nd](#)

[creating 2nd 3rd](#)

[managing](#)

[testing 2nd](#)

[Quorum Wait cluster resource state](#)

Index

[\[SYMBOL\]](#) [\[A\]](#) [\[B\]](#) [\[C\]](#) [\[D\]](#) [\[E\]](#) [\[F\]](#) [\[G\]](#) [\[H\]](#) [\[I\]](#) [\[J\]](#) [\[K\]](#) [\[L\]](#) [\[M\]](#) [\[N\]](#) [\[O\]](#) [\[P\]](#) [\[Q\]](#) [\[R\]](#) [\[S\]](#) [\[T\]](#) [\[U\]](#) [\[V\]](#) [\[W\]](#) [\[X\]](#) [\[Y\]](#) [\[Z\]](#)

[r \(read\) permission](#)

[RAID](#)

[__NSS support for](#)

[ravsui \(Rebuild And Verify Simple User Interface\) 2nd 3rd](#)

[ravview \(Rebuild And Verify Viewer\) 2nd 3rd](#)

[RBS 2nd 3rd 4th 5th 6th](#)

[__configuring 2nd 3rd](#)

[__object types 2nd](#)

[RBS Book object](#)

[RBS Collection object](#)

[RBS Module object](#)

[RBS Role object](#)

[__assigning to users 2nd](#)

[RBS Scope object](#)

[RBS Task object](#)

[rcd \(Red Carpet daemon\)](#)

[read \(r\) permission](#)

[Read property right](#)

[Read-Only attribute](#)

[Read-only attribute](#)

[Read-Only replicas](#)

[Read-Write attribute](#)

[Read/Write replicas](#)

[reboot command](#)

[Rebuild And Verify Simple User Interface \(ravsui\) 2nd 3rd](#)

[Rebuild And Verify Viewer \(ravview\) 2nd 3rd](#)

[Red Carpet software management system](#)

[__red-carpet 2nd 3rd 4th](#)

[__rug 2nd 3rd 4th 5th](#)

[Red Carpet utility](#)

[Red-Carpet 2nd](#)

[red-carpet utility 2nd 3rd 4th](#)

[regular expression](#)

[regular expressions 2nd](#)

[relative paths 2nd](#)

[Remote Administration module \(YaST\)](#)

[remote file access](#)

[__NFS \(Network File System\) 2nd 3rd 4th](#)

[__Samba 2nd 3rd 4th](#)

[remote graphical sessions 2nd](#)

[Remote Loader Service \(Identity Manager\)](#)

[__installing 2nd 3rd](#)

[__Remote Loader Console 2nd](#)

[remote shell access](#)

[rename command](#)

[Rename entry right](#)

[Rename Inhibit attribute](#)

[renaming](#)

[__eDirectory trees 2nd](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[salvaging files](#) 2nd 3rd

[Samba](#) 2nd 3rd 4th 5th 6th 7th

[components](#) 2nd

[installing](#) 2nd

[OES platform support](#)

[online documentation](#)

[printers, accessing](#)

[resource administration](#) 2nd 3rd

[resources, accessing](#)

[smb.conf file](#) 2nd

[user administration](#) 2nd

[Samba Client module \(YaST\)](#) 2nd 3rd

[Samba Server module \(YaST\)](#)

[sax2 utility](#) 2nd

[SBD \(Split-Brain Detector\)](#) 2nd

[scheduling](#)

[backups](#) 2nd

[QuickFinder index events](#) 2nd

[schema \(eDirectory\)](#) 2nd

[ndsrepair operations](#) 2nd

[Schema Sync background process](#)

[Script tab \(Novell Login dialog box\)](#) 2nd

[Search page \(QuickFinder Server Manager\)](#)

[search site settings](#) 2nd 3rd

[services settings](#) 2nd

[search services](#) [See [QuickFinder](#)]

[search sites \(QuickFinder\)](#) 2nd

[creating](#) 2nd 3rd

[managing](#) 2nd

[default search settings](#) 2nd 3rd

[general settings](#) 2nd 3rd

[index settings](#) 2nd 3rd

[print settings](#) 2nd

[security settings](#) 2nd

[Secure Shell \(SSH\) sessions](#) 2nd 3rd

[SecureShell for Windows](#)

[security](#)

[authentication](#)

[eDirectory login controls](#) 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th 13th 14th

[LDAP-aware services](#) 2nd 3rd

[Linux User Management \(LUM\)](#) 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th 13th 14th 15th

[native eDirectory-aware services](#) 2nd

[NetIdentity-based single sign-on](#) 2nd 3rd

[NMAS](#) 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th 13th 14th 15th 16th 17th

[QuickFinder site settings](#) 2nd

[authorization](#) 2nd

[access control lists](#) 2nd 3rd 4th 5th 6th

[effective rights](#) 2nd 3rd 4th

[explicit rights](#) 2nd

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[tail command](#)

[tape formats 2nd](#)

[tar command](#)

Target Service Agents [See [TSAs](#)]

[tcpdump command](#)

[technical support 2nd](#)

Telnet

[port assignment](#)

[telnet command](#)

[telnet connections](#)

text

 finding within files

[command-line tools 2nd 3rd](#)

[regular expressions 2nd](#)

text files

[editing 2nd 3rd 4th 5th 6th](#)

[processing commands 2nd](#)

[TFTP Server module \(YaST\)](#)

[Time Restrictions page \(iManager\) 2nd](#)

[Time Sync background process](#)

[time synchronization, verifying 2nd 3rd](#)

[Time Zone option \(Installation Settings page\)](#)

[timestamps, repairint 2nd](#)

[Tomcat Servlet Engine 2nd 3rd 4th](#)

[configuration files 2nd](#)

[initialization script 2nd](#)

[logs 2nd 3rd](#)

[OES platform support](#)

[online documentation](#)

[port assignment](#)

[starting/stopping manually](#)

[top command 2nd 3rd 4th](#)

Top Panel

[GNOME](#)

[touch command](#)

[Trace Configuration page \(DSTrace\) 2nd 3rd 4th 5th 6th](#)

[Trace History page \(DSTrace\)](#)

[Trace Triggers page \(DSTrace\)](#)

[traceroute command](#)

[tracing eDirectory activity 2nd 3rd](#)

[Transactional attribute](#)

[Transfer settings \(vsftpd.conf\) 2nd](#)

trees (eDirectory)

[renaming 2nd](#)

trees (eDirectory)

[design rules 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th](#)

[grafting 2nd](#)

[login options, specifying](#)

[merging 2nd](#)

Index

[\[SYMBOL\]](#) [\[A\]](#) [\[B\]](#) [\[C\]](#) [\[D\]](#) [\[E\]](#) [\[F\]](#) [\[G\]](#) [\[H\]](#) [\[I\]](#) [\[J\]](#) [\[K\]](#) [\[L\]](#) [\[M\]](#) [\[N\]](#) [\[O\]](#) [\[P\]](#) [\[Q\]](#) [\[R\]](#) [\[S\]](#) [\[T\]](#) [\[U\]](#) [\[V\]](#) [\[W\]](#) [\[X\]](#) [\[Y\]](#) [\[Z\]](#)

[UFR \(Unattended Full Repair\) 2nd 3rd](#)

[UID](#)

[root account 2nd](#)

[UML Installation module](#)

[umount command](#)

[uname command](#)

[uname r command](#)

[Unassigned cluster resource state](#)

[Unattended Full Repair \(UFR\) 2nd 3rd](#)

[unexpand command](#)

[uniq command](#)

[Universal Password \(NMAST\) 2nd 3rd 4th 5th](#)

[unix2edir utility](#)

[unix2edir.inp file](#)

[Unloading cluster resource state](#)

[unset command](#)

[Update Agent page \(Novell Client properties\)](#)

[updatedb command](#)

[updates](#)

[iPrint client updates 2nd](#)

[OES Linux 2nd 3rd 4th](#)

[Novell Update Service 2nd](#)

[upgrading](#)

[Novell Client](#)

[Automatic Client Upgrade \(ACU\) 2nd 3rd 4th](#)

[Novell Client Install Manager \(NCIMan\) 2nd 3rd 4th 5th](#)

[Novell Client Upgrade Agent 2nd 3rd](#)

[to OES Linux 2nd 3rd](#)

[Use Group Operations \(NRM\)](#)

[user accounts](#)

[local 2nd 3rd 4th 5th 6th](#)

[user binds 2nd](#)

[user forums](#)

[User Management page \(iFolder Management Console\) 2nd](#)

[User object](#)

[creating 2nd 3rd](#)

[User objects](#)

[LDAP binds 2nd](#)

[User role \(iPrint\)](#)

[User Template object](#)

[creating 2nd](#)

[user-level processes](#)

[command-line tools 2nd 3rd](#)

[useradd utility](#)

[userdel utility](#)

[usermod utility](#)

[users](#)

[customizing login](#)

[disk space, restricting 2nd](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[verify and rebuild operations \(NSS storage pools\) 2nd 3rd 4th](#)

[vhosts.template file](#)

[vi command](#)

[vi utility 2nd 3rd 4th 5th 6th](#)

[View File System \(NRM\)](#)

[View Start-up Log module \(YaST\)](#)

[View System Log module \(YaST\)](#)

[virtual desktops \(KDE\)](#)

[Virtual Network Computing \(VNC\) 2nd](#)

[Virtual Office](#)

[configuration requirements](#)

[configuring 2nd 3rd 4th](#)

[installing 2nd 3rd](#)

[logging options 2nd](#)

[OES platform support](#)

[portal options](#)

 services

[default services 2nd](#)

[virtual team services 2nd](#)

[services, configuring 2nd 3rd](#)

 virtual teams

[configuring services 2nd](#)

[creating 2nd](#)

[environment, configuring 2nd](#)

[information about, displaying](#)

[joining 2nd](#)

[managing 2nd](#)

[scheduling appointments/events](#)

[Virtual Office module \(YaST\)](#)

[virtual search servers](#)

[creating 2nd 3rd](#)

[managing](#)

[default search settings 2nd 3rd](#)

[general settings 2nd 3rd](#)

[index settings 2nd 3rd](#)

[print settings 2nd](#)

[security settings 2nd](#)

[virtual servers 2nd 3rd](#)

[Virtual Terminals 2nd 3rd](#)

[switching between](#)

[virtual workspaces](#)

[GNOME](#)

[virtual workspaces \(GNOME\)](#)

[vmlinuz-<version number\[clanbr\] file 2nd](#)

[vmstat command 2nd](#)

[VNC \(Virtual Network Computing\) 2nd](#)

[volumes](#)

 cluster-enabled volumes

[load/unload scripts, creating 2nd](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[w \(write\) permission](#)

[Wake-On-LAN \(WOL\) module](#)

[WBEM \(Web-Based Enterprise Management\)](#)

[wc command](#)

web browsers

[Ephiphany](#)

[iFolder, accessing 2nd](#)

[Konqueror](#)

web pages

[iPrint web pages](#)

web servers

 directories

[additional document directories 2nd](#)

[document root 2nd 3rd 4th](#)

[user home directories 2nd 3rd](#)

[MIME types, adding 2nd 3rd](#)

[Novell Client installation 2nd 3rd 4th](#)

web services

[Apache Web Server 2nd 3rd 4th 5th](#)

[adding website content 2nd](#)

[configuration 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th](#)

[iFolder and 2nd](#)

[initialization script 2nd](#)

[installing 2nd](#)

[MIME types, adding 2nd 3rd](#)

[modules 2nd](#)

[multiple websites, hosting 2nd 3rd](#)

[online documentation 2nd](#)

[publishing website content 2nd 3rd](#)

[storing web content 2nd 3rd 4th 5th](#)

[CGI \(Common Gateway Interface\) scripting](#)

[eGuide 2nd](#)

[accessing 2nd](#)

[configuring 2nd 3rd 4th](#)

[installing 2nd](#)

[js sb web services](#)

[MySQL 2nd](#)

Web services

[OES platform support 2nd](#)

web services

[Perl](#)

[PHP](#)

[port assignments, default 2nd](#)

[QuickFinder 2nd](#)

[capabilities 2nd](#)

[creating indexes 2nd 3rd](#)

[creating search sites 2nd 3rd](#)

[generating indexes](#)

[installing 2nd 3rd](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[x \(execute\) permission](#)

X server

[__credentials and 2nd](#)

[__tunneling 2nd](#)

X Window System

[__Xfree86 2nd 3rd 4th](#)

[Xfree86 2nd 3rd 4th](#)

[xosview command](#)

XSLT (Extensible Stylesheet Language Transformations)

[__Identity Manager and](#)

[Xterm graphical shell](#)

[Xtier framework 2nd](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[YaST 2nd](#)

- [Apache Web Server installation 2nd](#)
- [DHCP Server module 2nd](#)
- [DNS Server module 2nd](#)
- [document root directory, changing 2nd](#)
- [eGuide installation 2nd](#)
- [Hardware modules 2nd](#)
- [Health Monitoring Services \(HMS\), installing 2nd](#)
- HTTP Server module
 - [Apache configuration files, editing 2nd](#)
 - [document root directory, changing 2nd](#)
 - [virtual hosts, creating 2nd](#)
- iFolder
 - [installing 2nd 3rd 4th](#)
- iManaging
 - [installing 2nd](#)
- iPrint, [installing 2nd](#)
- Misc modules 2nd
- [NCS \(Novell Cluster Services\), installing 2nd 3rd](#)
- NetStorage
 - [installing 2nd 3rd 4th](#)
- [Network Devices modules 2nd 3rd](#)
- [Network Services modules 2nd 3rd 4th](#)
- [NSS, installing 2nd](#)
- Partitioner
 - [invoking](#)
- partitions
 - [non-NSS partitions, creating 2nd 3rd](#)
- [QuickFinder installation 2nd 3rd](#)
- [Samba Client module 2nd](#)
- [Security and Users modules 2nd](#)
- [SMS installation 2nd](#)
- [Software modules 2nd 3rd](#)
- [SySEconf utility 2nd](#)
- [System modules 2nd 3rd](#)
- [Virtual Office installation 2nd 3rd](#)
- [VSFTP server installation 2nd](#)
- [yast utility](#)
- [yast2 utility](#)
- [yelp utility 2nd](#)
- Yet another Setup Tool [See [YaST](#)]
- [YOU Server Configuration module](#)

Index

[[SYMBOL](#)] [[A](#)] [[B](#)] [[C](#)] [[D](#)] [[E](#)] [[F](#)] [[G](#)] [[H](#)] [[I](#)] [[J](#)] [[K](#)] [[L](#)] [[M](#)] [[N](#)] [[O](#)] [[P](#)] [[Q](#)] [[R](#)] [[S](#)] [[T](#)] [[U](#)] [[V](#)] [[W](#)] [[X](#)] [[Y](#)] [[Z](#)]
]

[Z shell](#)